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LINGUISTICS.—*Phonematic daylight in Lhiinkit, Navajo of the North.*[1] JOHN P. HARRINGTON, Bureau of American Ethnology.

If one were asked to enumerate the most outstanding native American languages, Aztec, Maya, Quechua, and Guaraní could be mentioned, and No. 5 could well be the Lhiinkit of North America, famous tongue of what is now southeastern Alaska and true closely related mother of the Navajo language spoken by North America's largest tribe. Lhiinkit is the Indian language that prevailed at Sitka, formerly Russian capital of Alaska, and at Juneau, present-day capital. Lhiinkit war canoes roved from Yakutat Bay in the north to Puget Sound in the south. The writings of the widely mentioned Veniaminoff and also standard modern Russian have Kolósh, Lhiinkit native, Kolóshi, plural, and it was from an aberrant form of this, transmission through German being apparent in the sch, that Powell, in part following Gallatin, published in 1891 "Koluschan" as his adoption for the stock consisting of the Lhiinkit language, which stock became revealed clearly by subsequent study as genetically related to the Skittagetan (Haida language) and to the Athapascan (including Navajo) linguistic families set up by Powell in the same pages. The word łiinkít is Lhiinkit for person, that is, Indian, and has been spelled in various ways, especially as Tlingit, the local pronunciation among the Whites being always Clingit, and the Russian name for the language and tribe having stuck in English not at all.

The Lhiinkit tribe was first discovered by Chirikof in 1741, whose ship got separated from that of Bering. A Russian fort was built in 1749 at Sitka, whose name means on the seaward side of Baranof Island. In 1802 the Lhiinkit Indians threw off the Russian authority at Sitka, only to be reconquered again in 1804, Sitka subsequently becoming the Russian capital of Alaska. The entire Lhiinkit region was acquired by the United States through purchase from Russia in 1867.

The Lhiinkit Indians are supposed to have numbered about 10,000 at the time of their discovery; their population is at present less than half that number. They represent the typical focus of Northwest Coast culture. They are bifurcated into raven and eagle moieties and have matrilineal descent, as depicted in totem poles and otherwise.

Fresh from the study of the Navajo language of the southwestern United States, I pried into the Lhiinkit language for genetic relationship with Navajo, and found it, amounting to practical identity in sounds and structure and lexical co-inheritance extending to some 400 vocables. Exactly like Navajo, Lhiinkit operates with a high and a low accent, and rarely both of these accentuations are to be found in one and the same Lhiinkít morphom, for instance Lh. łú, lù-, nose. Coming to comparison of consonants, these like the vowels show much discrepancy in their appearings, to such an extent that at this stage of the study comparative presentation of shifts can not well be made. Thus Lh. thè, stone, is patently the same word as Nav. tshé, stone, reminding one of such changes as are found in Quechua dialects, while Lh. khèł, dog, Nav. łi', pet, reflect some ancient metathesis. In order correctly to understand correspondences, one would have to know the ancient development of forms, which lack of record forever deprives us of knowing.

[1] Received August 29, 1944.

Anyone who might look into the Lhiinkit, Haida, and Athapascan languages at all would see the thorough resemblance, and Boas early observed and reported on this resemblance. Sapir[2] later united these stocks, calling them "Na-dene." This discovery was not followed up by Sapir, at least not with further publications of comparison. Contemporaneous with Sapir's article, Boas worked with Shotridge, a Lhiinkit-speaking Indian employed by the University Museum, Philadelphia, and published as the result his "Grammatical Notes on the Language of the Tlingit Indians."[3] In this paper Boas sets forth sweepingly and definitely for the first time that Lhiinkit has as its accentuation preeminently high- and low-pitched syllables, which later proved to be true also of Navajo and is the case with many languages. Also he gave much better presentation than had been given before of sounds and elements of Lhiinkit.

Boas studied with Shotridge the Chilcat dialect of the northern mainland. I studied the Prince of Wales Island dialect, that of the southwesternmost large island, and the illustrative forms given below are all from this dialect. The dialects of the Lhiinkit language differ to a comparatively slight degree from one another.

The prime essential to comparative work is that if possible the languages to be compared should be studied by one and the same individual. Studying Lhiinkit fresh from Navajo, I enjoyed an advantage in having both languages in mind. It is to be regretted that structure follows mastery of sounds, and that the limits of the present publication prescribe a dealing only with the sounds. The main purpose of this paper[4] is to present the constituent sounds of Lhiinkit. As in all other languages, these sounds fall into vowels and consonants.

Vowels

The Lhiinkit vowels as regards quantity are only four in number: a, u, e, i. These are exactly the four vowels of Navajo. It is the Lhiinkit lack of o that makes the native say, for instance, fúum instead of foam when talking English. The vowels are appositionalized as shorts and longs, the former tending to take on the secondary feature of centralized quality. Nasalized counterparts of these vowels have arisen in Navajo, mainly through the eating into the vowel of a syllable-closing nasal consonant, but nasalized counterparts do not occur in Lhiinkit.

The short vowels of Lhiinkit are, of course, as short as it is practical to pronounce them and tend toward being centralized or obscured, while an adjacent consonant can sometimes be detected as having an influence; for instance, the sequence wa in Lhiinkit has regularly the a-quality of English water. In fact, an a in Lhiinkit has in certain instances a labializing effect on an immediately following consonant. Thus Lh. hínnà-k'w, (1) a little water, (2) a drink of water, is the diminutive of the word for water, yet for instance tù-yyít-k', his little son, diminutive of son with possessive pronoun, has its -k' unlabialized. The long vowels of Lhiinkit and of Navajo can well be written by doubling, just as has been practiced by Thalbitzer in writing Eskimo and is recommended by high authority for the writing of African languages.

Quality vowel change

The Lhiinkit language has three quality ablauts of its vowels: e versus a, e versus ee, i versus ii. These are illustrated by the following:

thè, stone; thà-yyìis, wedge.
cé, blood; ìi-ccée, it is bleeding.
'à-kk'ít, my buttocks; hàstù-kk'íi-x', dpl. their buttocks.

Vowel diphthongs

In Lhiinkit vowel diphthongs are heard clearly and easily to consist of a short or long vowel plus ww or yy. The second element of the diphthong always tends to be held, but is often very centralized. The consonantal character of the second element is brought out when the preceding is of the

[2] Sapir, Edward, *The Na-dene languages, a preliminary report.* Amer. Anthrop. 17: 231–266. 1915.

[3] Boas, Franz, Univ. Pennsylvania Anthrop. Publ. 8(1): 1–179. 1917.

[4] The use of the term "daylight" in the title of this paper is in keeping with the widely known Lhiinkit myth that Raven let loose the daylight for the people.

same general quality. The following words exemplify vowel diphthongs:

'áyy, interjection of disgust.
t'áaww, feather.
nèyy, listen!
ɬ'éeww, sand.
'úww, ouch!
'úuww, buy it!

PITCH

There are in Lhiinkit, just as in Navajo, only two accents, which can also be spoken of as pitches or tones: high and low. This feature has already been set forth above, but deserves remention here as in proper place, since it concerns primarily vowels and vowel diphthongs.

Sometimes the accent distinguishes what would otherwise be homophones. Thus:

X'úun, fur-seal; X'ùun, fallen-tree.
'íi&, out at the beach; 'ìi&, (1) copper, (2) soldering-iron.
Xáayy, yellow cedar; Xàayy, sweathouse.

Words of most different meanings are as often exact phonetic homophones. Thus:

'áa, (1) lake, (2) he is sitting.
thàan, (1) sea-lion, (2) navel cord.

Boas states that many postfixes put in appearance as high and as low, this being brought about by the postfix taking a pitch the opposite to that of the base to which it is attached, but Boas gives his finding of only two: -yí, -yì, possessional, and -tée, -tèe, to. And I have been able to find only these same two.

STRESS

The making prominent by loudening of the final low syllable of a coherence-group, and of certain other low syllables, is not indicated by Boas.

CONSONANTS

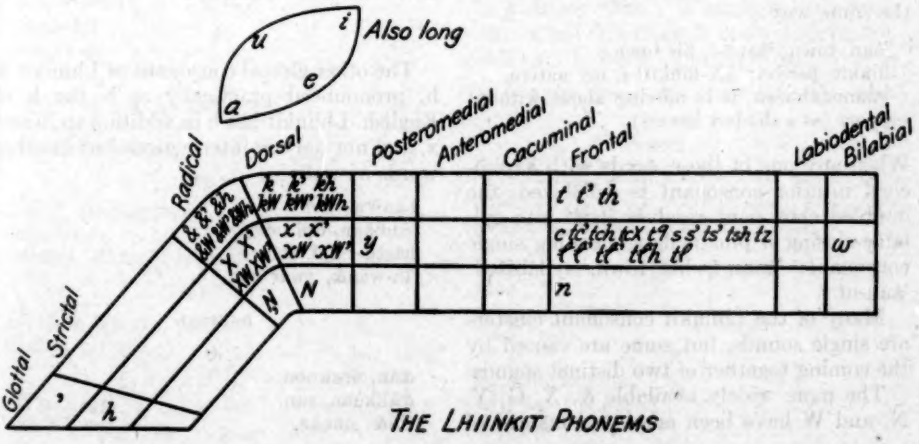
The articulative tract for producing consonants is much longer than that employed for the production of vowels, the vowel producing section being only a small central part of the long consonant tract.

The consonants of Lhiinkit are very numerous and on the whole impress one as being forceful and audible above the noise of waves and the murmurings of the forest. The buccal or mouth consonants are trifurcated into plain, clicked, and aspirated varieties, the first pronounced as in French, the second clicked like the clicked consonants of Georgian and Ethiopian, the last pronounced with a distinct h after the consonant, like Mr. Dooley's "t-hake." Lhiinkit tsh does not occur at all, but tch occurs, which has also an overaspirated by-form occurring only in one word: tcXán, grandchild (instead of *tchán).

Even y interchanges with w in the possessional. Thus -yí, -yì, when following the vowel u, certain á's, or the consonant w appears as -wú, -wù. The earlier forms must have been *-Gí, *-Gì, -*Gú, -*Gù.

A buccal clusive telescopes with alif to become a clicked clusive.

Alifized fricatives have the alif pro-



THE LHIINKIT PHONEMS

nounced after the fricative. Thus, for instance, s'.

Both unaspirated and aspirated clusives occur at the beginning of or in the interior of words, but the unaspirated when etymofinal or pausal become aspirated. łit, room, has t which becomes by positionality aspirated, whereas 'łith, place, has aspirated th, so one forms 'àX-'łitt-í, my room, but 'àX-'łith-í, my place.

Consonant diphthongs having the second member consisting of a voiced fricative, for instance kw, tz, tl, have this second member voiceless when pausal: yàakw, canoe, pronounced pausally with voiceless w. The labialized clusives of this group are of two origins: those having labialization induced by preceding sound and those labialization not having so induced; but of whichever origin they are handled exactly the same. This phenomenon is only a phase of that formulated into statement in the preceding paragraph as regards the aspirating when final of otherwise unaspirated clusives, but since one is cut from knowledge of the history of the language, it is practical to make a separate statement about consonant diphthongs with voiced last member separately.

In Lhiinkit, as in Navajo, a consonant sound between vowels within a word is lengthened or held, reminding one of yy and ww, sole second members of vowel diphthongs mentioned above, and it is the tendency in Lhiinkit and in Navajo to lengthen an intervocalic consonant so positioned by the coming together of words in the same way:

'àan, town; 'àann-í, his town.
łiinkít, person; 'àX-łiinkítt-í, my native.
yàannàahhéen, it is moving about without support (as a shadow hovers).

When any one of these words with lengthened interior consonant is syllabized, the doubled consonant resolves itself into syllable-closing h plus syllable-opening single consonant: 'àann-í, his town, syllabized: 'àah-ní.

Many of the Lhiinkit consonant clusters are single sounds, but some are caused by the coming together of two distinct sounds.

The more widely available &, X, G, Y, N, and W have been employed instead of less widely available characters for the radical clusive, the radical fricative, open g, superior y, dorsal n, and superior w, respectively. For practical orthography w can be used for W.

We next list the Lhiinkit consonants, finding them to occur produced in five articulatory positions.

GLOTTAL

'

The apostrophe is here pressed into service for indicating the sound produced by the closure of the glottis or vocal cord chink, which sound is known in Arabic grammar as alif, or more precisely as hamsated alif. In Lhiinkit, just as in Arabic, no word begins with a vowel, but an etymoinitial vowel is begun with an alif, a procedure that in the language of singing would be termed a hard attack, and that can be well compared to the teeing of a clarinet at the beginning of each note; it need not be written, but since it is becomes prominent as a "hiatus" when a word ending in a vowel precedes, it is best written. a', being a consonant, is treated like any other consonant and between vowels becomes doubled.

'àan, village.
wà"é, you.

The colliding of alif with a clusive produces the clicked variety of clusive, for instance, t', the mouth closure smacking against the glottis closure with the result that the t becomes clicked or clucked.

h

The other glottal consonant of Lhiinkit is h, pronounced practically as is the h of English. Lhiinkit has h in addition to X and x, and not only in interjections but in other words as well:

hàaww, well!
'ùhhàan, dpl. we.
hàstù-, dpl. their.
'łh-wáa&, your eye.

RADICAL

&

&án, firewood.
&àkkàan, sun.
s'łi&, smoke.

&'

tháa&&'àa, mosquito.
t'ìi&', ice.

&h

&hà, and.
&háa, man-in-prime.
&hù, to go in a canoe.
tà&&hàan, dpl. they are quarreling.

&W

Found in the material to occur only in &wáattlàn, Portland, and this is suspected to be more properly &wháattlàn.

&W'

&W'àn, to dry salmon.

&Wh

&Whéan, person of a place.

X

Xàt, I.
Xàat, root.
XùX, husband.

X'

X'àan, fire.
CthàXX'ìin, Stikine River.

XW

XWàaXXás', I mended it with roots.

XW'

No sure example can be found.

N̨

'àn̨&háawwù, rich-man (assimilated from 'àn&háawwù).

DORSAL

k

kùut9, hill.
nìik, news.

k'

k'issàannì, group of youths.
'àtk'àhhìin, believer.
tc'àak', bald eagle.

kh

kháat', digging stick.
khèetl, dog.
Clìkkhá, Baranof Island.

kW

kWàł, to hit with the fist.
tłhákw, always.

kW'

kW'at', egg.
'ankW', cry baby.

kWh

kWhéeyy, mark.

x

xàas, horse.
Ts'uutxxàn, Tsimshian person.
t'èex, fishhook.

x'

This is perhaps the most difficult sound of the language, for those who are not native speakers, to make quick and approximately correct adjustment for. Perhaps to make the sound more distinct from X', almost xY' is pronounced.

x'àat', island.
thàaxx'áł', needle.
théex', heart.

xW

xWèe, (1) interjection of surpressed expectancy, (2) interjection of fatigue.
yàXtlxxWás', it is hanging.
s'àaxW, hat.

xW'

xW'àał, (1) featherdown, (2) euphemistic substitute word for tàł, (1) halibut-club, (2) weight.
'ùnnànnáa-xW', dpl. inland mainland Indians.

N

łìiNkít, person (assimilated from łìinkít, which latter form is the more commonly heard form).

POSTEROMEDIAL

y

yàan, hunger.
yíit, son.

The noticing that y if made a little more fricative is GY makes it more understandable how y in Lhiinkit interchanges with w:

tù-t'ásyyì, his board, but 'àX-&háawwù. my man.

FRONTAL

The most remarkable fact about the frontal series of Lhiinkit is that, just as in Navajo, tc, ts, and tł do not occur.

t

tèeX', 2.
nàttáakW, table.
Xàat, root.

t'

t'á, king salmon.
yàtt'àa, it is warm.
łìit', eel.

th

thè, stone.

c

càa, mountain.
khèeccíc, alder.
'liccáan, pitiable.
wác, cheek.

tc'

tc'àak', bald eagle.
wùltc'éXW', it is dirty.

tch

tchán, stink.
yàantàttchúun, (1) it is straight, (2) it is true.

tcX

This overaspirated form of tch has been found to occur only in one word: tcXán, grandchild. The commonly used form of this is always the diminutive, tcXán-k', grandchild.

t9

t9ín, hand.
'lh-cù&&hàtt9áa, let me show you how.
'íit9, half-submerged rock.

s

síik, belt.
khìs, bracelet.

s'

s'àaxW, hat.
kùus', cloud.
&hùkkáas', fog.

ts'

'àtts'ùuts', it is jerking (on the fishline).

tsh

tshàa, hair seal.

tz

tzàas, thong.
łłttzíi, it is difficult.
ts'ùtzkW, bird.

ł

łèe', red-ocher.
khàłłttzíi, it is somewhat difficult.
thìił, scar.

ł'

ł'úut', tongue.
'éeł, (1) ocean, (2) salt.

tł'

tł'ù, rotten.
tł'ìi, (1) finger, (2) toe.

tłh

tłhàa, mother.
-tłhén, augmentative

tł

tłéet, (1) snow, (2) whiteness.
xàatl, iceberg.

n

nàa, tribe. This word is the prebase of Sapir's Na-dene, proposed as a stock name (see above); the postbase is a reflex of Nav. tinné, also tinnę, person, Indian, and related forms following Morice's attempt to replace the term Athapascan by "Déné."

'Ànnúucci, Russian person, said to be from Russian Rùsskiy, a Russian.

'àan, town.

LABIAL

The absence of lip sounds except w in Lhiinkit has been noticed by various observers and is regarded as a trait of superiority by the natives themselves, who feel that throat and tongue adjustments are more easily negotiable than lip adjustments. Russian and English with their full measure of lip sounds get loan-words from these languages into Lhiinkit reflexed by the nearest thing to them, which is such sounds as &W, kW. Foreign m is twisted to w. Appearance of y as w has been given above.

wát, river-mouth.
wùun, maggot.
wán, edge.
Hínt9itchwàan, Englishman (from this).
łéekWà, bread (from Russian xléb, bread).
&Wáattlàn, Portland (from this).

ENTOMOLOGY.—*Preliminary life-history studies in Guam of the scarab beetle* Ancylonycha mindanaona (*Brenske*).[1] R. G. OAKLEY, U. S. Bureau of Entomology and Plant Quarantine. (Communicated by ALAN STONE.)

Severe attacks by larvae of the scarab *Ancylonycha mindanaona* (Brenske) on the Island of Guam in 1937–38 destroyed many young corn plantings. The insect, probably introduced from the Philippine Islands at some undetermined time, first occurred in damaging numbers on corn in 1935, according to reports, but became of increasing importance in 1937. These destructive appearances of the beetle may have been sporadic in nature, or they may have been due to a population build-up during the years subsequent to its supposed introduction. Its future importance to Guam's major food crop is a matter of conjecture.

To determine the habits of the insect as a basis on which to attempt control measures, studies of the pest were conducted by the writer during the period from June, 1937, to July, 1939, at odd times when other duties, including the enforcement of plant quarantines, permitted. Owing to the discontinuity of these studies and lack of equipment, the results obtained can not be considered either conclusive or complete. The data acquired may be of some value to Island agriculture, however, and are therefore summarized below.

HISTORY

Ancylonycha mindanaona was described by Brenske in 1893 under the generic name *Holotrichia* from specimens collected on the Island of Mindanao, Philippine Islands. It is probably indigenous to the Philippines, where its importance is unknown to the writer, literature on the subject not being available. Dammerman (1929) reported a related species, (*Holotrichia*) *A. vidua* (Sharp), as a commonly mentioned root pest there in 1929, and Lopez (1931) stated in 1929 that a little-studied species of *Ancylonycha*, probably *vidua*, was responsible for extensive damage to sugarcane.

The presence of *Ancylonycha mindanaona* in Guam was first definitely established in 1936 when Swezey submitted specimens collected on banana leaves to the Bureau of Science, Manila, P. I., for specific determination. Vandenberg (1931) recorded "*Lachnosterna* sp." as attacking pineapple roots on Guam. It is considered possible that he had reference to the form identified as *mindanaona* by the Bureau of Science, and by Böving at the United States National Museum in 1937 from specimens collected in Guam.

DISTRIBUTION IN GUAM

Nine of the Island's 17 districts were known to be infested by *Ancylonycha mindanaona* in July, 1939, although damaging infestations of outstanding importance had been found only in the districts of Asan, Tumon, and Dededo. The thickly dotted areas in Fig. 1 represent those districts bearing the heavier infestations, whereas the thinly dotted areas in the districts of Sumay, Piti, Agana, Sinajana, Barrigada, and Yona represent localities where infestations were more sparsely distributed. Significant damage to economic crops was only rarely found in the lightly infested districts.

ECONOMIC IMPORTANCE

The economic value of crops destroyed in Guam by *Ancylonycha mindanaona* was insignificant when compared with damage inflicted by a major pest in the United States. To the Guam farmer, however, who can cultivate only a small acreage with his primitive hand tools, losses sustained from attacks of the pest on corn represented part of a season's labor and a subsequent lack of his principal food supply until a second crop could be produced 9 months later, when rainfall again became favorable. Some farmers, rather than attempt to continue cultivations and suffer crop losses, actually

[1] The writer gratefully acknowledges the cooperation of the Naval Government of Guam in supplying the excellent services of José I. Cruz to assist in investigative studies, and the kind assistance received from Dr. E. A. Chapin, curator of insects in the United States National Museum, who prepared the description of the adult in this paper, and from A. D. Cushman, who prepared the drawings. Received October 4, 1944.

transferred their farming operations to non-infested areas.

Both larvae and adults are very voracious feeders, the former attacking lateral and tap roots, the latter feeding on the leaves. In October, 1937, 10 fields of young corn located at Dededo exhibited plant losses

FIG. 1—Map of Guam showing relative infestations of *Ancylonycha mindanaona* and infested localities.

ranging from 35 to 95 percent on sites where infestations ranged from 0.4 to 1.2 larvae per square foot of surface-soil area. A larval infestation slightly exceeding an average of 1 specimen per square foot was sufficient to destroy most of the young corn plants. In June, 1938, adults demonstrated their destructiveness to tasseling corn by causing an estimated defoliation of 50 percent in several fields observed. From March to May of the same year many banana leaves in the Dededo district were denuded and large portions of the leafy area on coconut palms were stripped by the beetles.

FOOD PLANTS

Surveys of adult and larval infestations from 1937 to 1939 revealed hosts to be attacked as indicated below.

Cultivated Hosts	*Stage of Pest*
Avocados (*Persea* spp.)	Adults
Bananas (*Musa* spp.)	Adults
Beans (*Phaseolus* spp.)	Larvae
Breadfruit (*Artocarpus* spp.)	Adults
Cassava (*Manihot utilissima*)	Adults
Citrus (*Citrus* spp.)	Larvae
Coconut palm (*Cocos nucifera*)	Adults and larvae
Coffee (*Coffea* spp.)	Larvae
Corn (*Zea mays*)	Adults and larvae
Kapok (*Ceiba pentandra*)	Adults
Wild Hosts	
(Baryxylum) *Peltophorum inerme*	Adults
Bauhinia malabarica	Adults
Carissa arduina	Adults
Cestrum pallidum	Adults
Euphorbia didyma	Adults
Grasses (several varieties)	Larvae
Guamia marannae	Larvae
Hibiscus tiliaceus	Adults
Leucaena glauca	Adults
Malpighia glabra	Adults
Phyllanthus sp.	Larvae
Pithecellobium dulce	Adults
Sida rhombifolia	Larvae
Urena lobata	Larvae

There are probably other hosts in addition to those in the foregoing list. Roots of grasses, weeds, corn, and coconut palms are preferred hosts of the larvae, while leaves of bananas, coconut palms, tasseling corn, and Manila tamarind (*Pithecellobium dulce*) are preferred by adults.

DESCRIPTION

EGG

The freshly deposited egg is pearly white, elliptical, approximately 2 mm in length, and slightly more than 1 mm in diameter. It begins enlarging on the second day of incubation, becomes oval by the fifth day, and attains a size from 2 to 3 times the original before it hatches.

LARVA AND PUPA

Descriptions by Dr. Adam G. Böving may be found in the following paper herein.

ADULT

The original description of *Ancylonycha mindanaona* by Brenske was somewhat brief. The ensuing description was therefore prepared by Dr. E. A. Chapin:

Color above medium to pale castaneous, head and pronotum slightly darker than elytra,

underparts paler, yellowish brown, legs castaneous with extreme apices of tibiae (entire outer margin of anterior tibia) darker, apices of mandibles and maxillae nearly black.

Head coarsely and closely punctured, the punctures tending to form longitudinal groups of two or three. Clypeal suture slightly sinuate, clypeus with strongly reflexed anterior margin which is very broadly and very feebly notched at middle. Antenna 10-segmented, club in male about as long as first segment, in female about three-fourths as long as first.

Pronotum more than twice as broad as its length along median line, all margins finely beaded, apical angles subacute, basal angles obtuse, lateral margins nearly parallel in apical fourth, thence strongly diverging to basal third, the point of greatest breadth of pronotum. Surface moderately coarsely and sparsely punctured on disc, more finely and densely punctured in lateral thirds.

Scutellum broadly triangular, with a few coarse punctures.

Elytron with prominent humeral callus and moderately convex sutural bead, apical sutural angles in male minutely mucronate, in female simple. Surface as coarsely and slightly more densely punctured than disc of pronotum, with very feeble traces of three discal costae. Pygidium sparsely and coarsely punctured.

Underparts of metathorax rather finely and densely punctured, rather densely clothed with pale hair. Abdominal sternites, except terminal, completely anchylosed with sutures obliterated across middle, very sparsely punctured at middle, more dense laterally. Terminal sternites not notably different in the sexes. Tarsal claw strong, moderately curved, accessory tooth acute and subbasal.

Aedeagus, Figs. 1–3; female genital plates, Fig. 4.

Length: 17–19 mm.

Known distribution: Philippine Islands (Mindanao and Luzon); Guam.

The identification of the Guam specimens was based on comparison with material from Mindanao in the C. F. Baker Collection identified by the late J. Moser.

LIFE HISTORY AND HABITS

Studies of the life history of *Ancylonycha mindanaona* were conducted under field conditions from July, 1937, to May, 1939, and in an open-air insectary from March through May in 1938–39, when pupae, adults, and eggs were abundant. Adults collected in the field in April, 1938, were confined to cages kept in an undisturbed shed, because females would not oviposit under insectary conditions.

DEVELOPMENTAL PERIODS

The records shown in Table 1 were obtained for eggs in April, 1938, for larvae from April, 1938, to March, 1939, and for pupae, including some specimens developing from mature larvae collected in the field, from March to May, 1938–39. It may be seen from these that the insect has an annual life history.

TABLE 1.—LENGTH OF IMMATURE STAGES OF ANCYLONYCHA MINDANAONA UNDER CAGE CONDITIONS

Stage	Specimens	Length of Stage		
		Minimum	Maximum	Average
	Number	*Days*	*Days*	*Days*
Egg	205	11	15	12.1
Larva	19	290	309	301
Prepupa	45	5	20	[1]
Pupa	30	16	20	17.4
Egg to adult	19	323	346	335

[1] No complete data.

The eggs studied were deposited by the beetles in boxes of sifted moist soil placed in cages with adults early in the morning and removed at dusk when beetles emerged to feed. Eggs were incubated in small tins and in partially open petri dishes containing moist soil.

Newly hatched larvae were placed in drums containing a mixture of leafmold and soil previously planted to centipedegrass, *Eremochloa ophiuroides*. Periodical observations of the grass roots established approximate periods when larvae changed from feeding on soil organic matter to living plant material. On January 31, 1939, the larvae, having discontinued their feeding, were transferred singly into vials containing sufficient soil for the formation of pupal cells. After entering the prepupal stage each specimen was placed on a layer of cellu-

cotton covering a layer of soil, needed to supply moisture, in a vial where dates of pupation and final transformation to adult could be established. The open end of every vial was loosely plugged with cotton to retard the escape of moisture. Subsequent attempts to ascertain pre-emergence periods of adults newly transformed from pupae, by holding them separately in caged tin cans of soil under insectary conditions, resulted in failures, as no specimens emerged and all died within a few weeks.

LARVA

The length of the larval stage, ranging from 290 to 309 days (Table 1), was possibly shortened under cage conditions. The young larva, hatching in March or April, remains at a depth of 5 or 6 inches in the soil, where it feeds on decaying organic matter until it is almost full-grown in July, when the summer rainy season begins. Moisture conditions then being favorable, it rises closer to the soil surface to attack living roots of an abundant weedy and grass growth, or other hosts. If the host is cleared away before November and is replaced by a cultivated crop, the latter—corn for example—is attacked as soon as roots develop. The larva burrows more deeply into the soil from late November to January, probably to escape dry surface-soil conditions following reduction in rainfall, and forms an earthen pupal cell by January if a food supply is absent. Some larvae may continue feeding until March or later if a host is available. The cell is usually to be found near a limestone rock formation ranging in depth, at Dededo, from 5 to 13 inches. The latter depth is generally sought, judged from groups of mature larvae and pupae often found in small areas where the soil was slightly deeper than the average surrounding soil depth. The larva remains in the cell for days, or even weeks, turns slightly brown, becomes limp, shrinks to almost half its former size, and finally casts its skin to become a pupa.

PUPA

The first noticeable change in a pupa in transforming to an adult is the early replacement of the pearly-white color by a creamy color. The eyes and tibia become slightly brown on the fifth day, as do the head and thorax on the seventh day. The entire specimen is brown by the eleventh or twelfth day. The pupal skin is then cast several days later to complete the transformation.

ADULT

Feeding habits.—The adult remains in its pupal cell for several days after transformation, before emerging to feed. After maturity, it emerges from the soil at dusk, flies

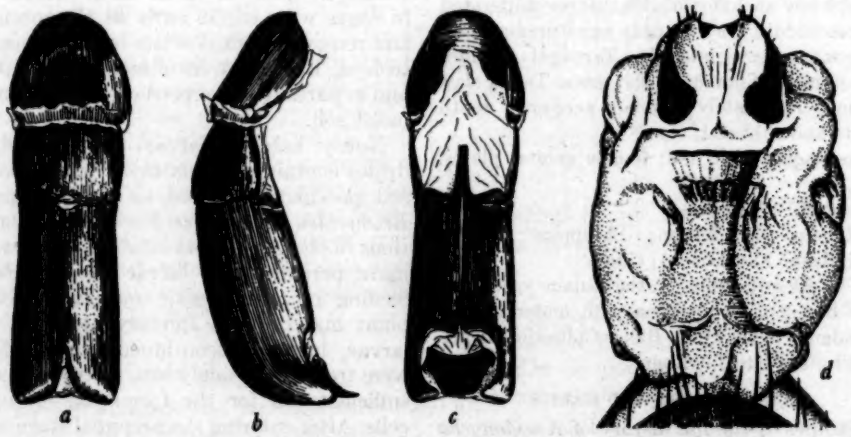


FIG. 2.—*Ancylonycha mindanaona: a–c*, male genitalia; *d*, female genitalia. Drawings by A. D. Cushman.

briefly or until a desirable host is reached, then feeds voraciously for an hour or two on the outer edge of a leaf. It mates later during the night and continues to feed until just before daybreak, when it flies to soil nearby, hiding during the day at depths of 2 to 6 inches.

The adult probably continues to feed nightly throughout its life after its emergence from the pupal cell. Although average adult longevity appears to be of only a few weeks' duration, the individual beetle consumes a large amount of leafy material.

Oviposition habits.—When a female discontinues feeding at daybreak, it flies to the ground, burrows to a depth of from 4 to 6 inches, and spends the day either resting or ovipositing. Eggs are laid singly, or in groups of 2 to 5. A glutinous substance secreted on each egg causes soil to adhere to it as a protective covering. The total number of eggs an adult may deposit was not established, although dissections of numerous females indicated an average of about 30.

Small valleys or depressions where moisture prevailed during the dry season appeared to be more favorable to larval survival but were apparently given little preference by females for oviposition sites. It even seemed doubtful that the type of plant cover had much influence on the selection of places for oviposition. That there was some selection of loose soils is supported by the fact that larvae were found mostly in sandy portions of lowland soils at Piti in 1938–39. Adults probably had difficulty in penetrating the clay loam soils, particularly in uncultivated areas, which were dry and well baked during the season of oviposition. Concentrations of larvae in Dededo fields during the fall of 1937–38 were invariably found near host plants of the adults. In one cornfield, for example, 100 percent of the plants were destroyed by larvae in an area located within 75 feet from the forest edge, but at a greater distance only an occasional plant was molested.

SEASONAL OCCURRENCE

There is a slight overlapping of the one generation per year of *Ancylonycha mindanaona* in Guam (Table 2).

TABLE 2.—SEASONAL OCCURRENCE OF THE VARIOUS STAGES OF ANCYLONYCHA MINDANAONA AT DEDEDO, GUAM, IN 1938–39

Stage	Period of occurrence[1]	Period of greatest prevalence
Adults	Feb. 20 to Aug. 15	March 15 to April 30
Eggs	Feb. 25 to June 1	March and April
Larvae	March 10 to May 25 of succeeding year	June and July
Pupae	Feb. 1 to May 30	March

[1] Exact dates given represent the earliest and latest dates on which individuals were actually observed in the field.

At Dededo in 1938 the beetle flight began late in February and at Piti early in March. During the same year the maximum flight occurred about April 20 at the latter place, according to data obtained from small catches of beetles in light traps. The data also showed a rapid decline in the population later and a complete disappearance of beetles by August 6. Oviposition begins almost immediately after the first beetle emergence, but apparently ceases long before the last beetles of a season disappear.

Larvae of a single generation occur over a period covering almost 15 months (Table 2). The peak population is reached in June or July, or within 3 to 4 months after the first appearance of larvae in March, then starts to decline. It develops during a period of dry weather, which may cause considerable mortality of both eggs and young larvae. The 1938 generation appeared small in size in July, by comparison with the number of beetles present to oviposit in the previous March and April, and was less than one-fifth of its maximum level by January, 1939, according to results of surveys conducted in 10 fields. Maximum concentrations of approximately 8 larvae per square foot of surface soil existed in July at one site, as compared with 1 larva per 10 square feet in November.

CLIMATIC AND SOIL CONDITIONS IN GUAM POSSIBLY AFFECTING LIFE HISTORY

Soils on the Island of Guam are largely of three general types—the shallow upland limestone type, lowland clay loams, and savannah lands. The upland soils are porous and shallow with an underlying limestone-rock formation, of which outcroppings are frequently to be seen; are usually from 6 to

8 inches in depth but may be a few inches deeper at some sites; and have little water-holding capacity. The lowland and savannah-land soils are several feet in depth; the former having small sandy areas in spots. The savannah soils cover the greater portion of the southern half of the Island and produce a thick growth of swordgrass. Infestations of *Ancylonycha mindanaona* were most severe in the loose upland soils prevalent at Dededo and near Asan, and in the limited sandy areas in the lowland at Piti. No infestations were observed in the savannah lands.

The average total annual rainfall in Guam for the period July 1, 1937, to June 30, 1939, was 79.77 inches, a reduction from a normal average of approximately 95 inches. Most of it occurred during a distinct rainy season extending from June to November and was followed by a dry season from January to May during which time the average monthly rainfall amounted to less than 5 inches. The temperature and relative humidity were less variable, the former ranging from 71° to 92°F. and the latter averaging 80.8 percent. Daily mean minimum and mean maximum temperatures approximated 74° and 87°, respectively.

Crops growing in lowland areas during the period from December to June suffer from lack of rainfall; nevertheless they often yield fair-sized harvests. Those in upland areas, however, must as a general rule reach maturity by December, in order to escape drastic effects of too little rainfall from that month to the following May. Young crops are likely to be drowned out in either area by excessive rainfall, sometimes exceeding 25 inches, in August. Favorable months for planting corn in the upland areas are therefore limited to May, June, September, and October. The problems of successful grain storage, inadequate land acreage for cultivation, and an even distribution of labor make plantings in the two last-named months very desirable, yet they fit favorably into the habits of the larvae of *Ancylonycha mindanaona*.

SUMMARY

The scarabaeid beetle *Ancylonycha mindanaona* (Brenske) was a destructive pest in both the larval and adult stages in Guam in 1937–38. The 1939 generation was smaller than the previous ones. The larvae feed on roots of plants and the adults attack foliage at night.

Life-history studies proved that the pest completed its cycle in one year, with an egg stage of from 11 to 15 days, an approximate 10-month larval stage, and a pupal stage of 16 to 18 days. Eggs occur largely from March to May, larvae from March of one year to March of the following year, pupae from February to May, and adults from February to August with the peak in April.

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ENTOMOLOGY.—*Description of the larva and pupa of the scarab beetle* Ancylonycha mindanaona (*Brenske*).[1] ADAM G. BÖVING, U. S. Bureau of Entomology and Plant Quarantine.

In the larval stage *Ancylonycha* appears congeneric with the genus *Phyllophaga* from the mainland of America and is inseparable from it except on geographical grounds. To be sure, the larva of *Ancylonycha mindanaona* is readily separated from all the species of *Phyllophaga* by possessing numerous round, dark spots (*DS*, Figs. 3, 7) on different places of the body, but similar dark spots have not been found on the larva of any other known species of *Ancylonycha* and must therefore be considered as a specific, not a generic, character. The larva of *A. mindanaona* comes very close to the larvae of the least-differentiated species of *Phyllophaga*, notably to the larvae of *P. vetula* (Horn), *P. crinita* (Burmeister), and *P. tristis* (Fabricius).

In the following description of the three larval instars of *A. mindanaona*, little regard is paid to the tribal and generic characters, which, as mentioned, are identical with those well known in the corresponding instars of *Phyllophaga*. On the other hand, all the specific characters are given that show the systematic relation of *Ancylonycha mindanaona* to the different species of *Phyllophaga* and especially the three above-named forms.

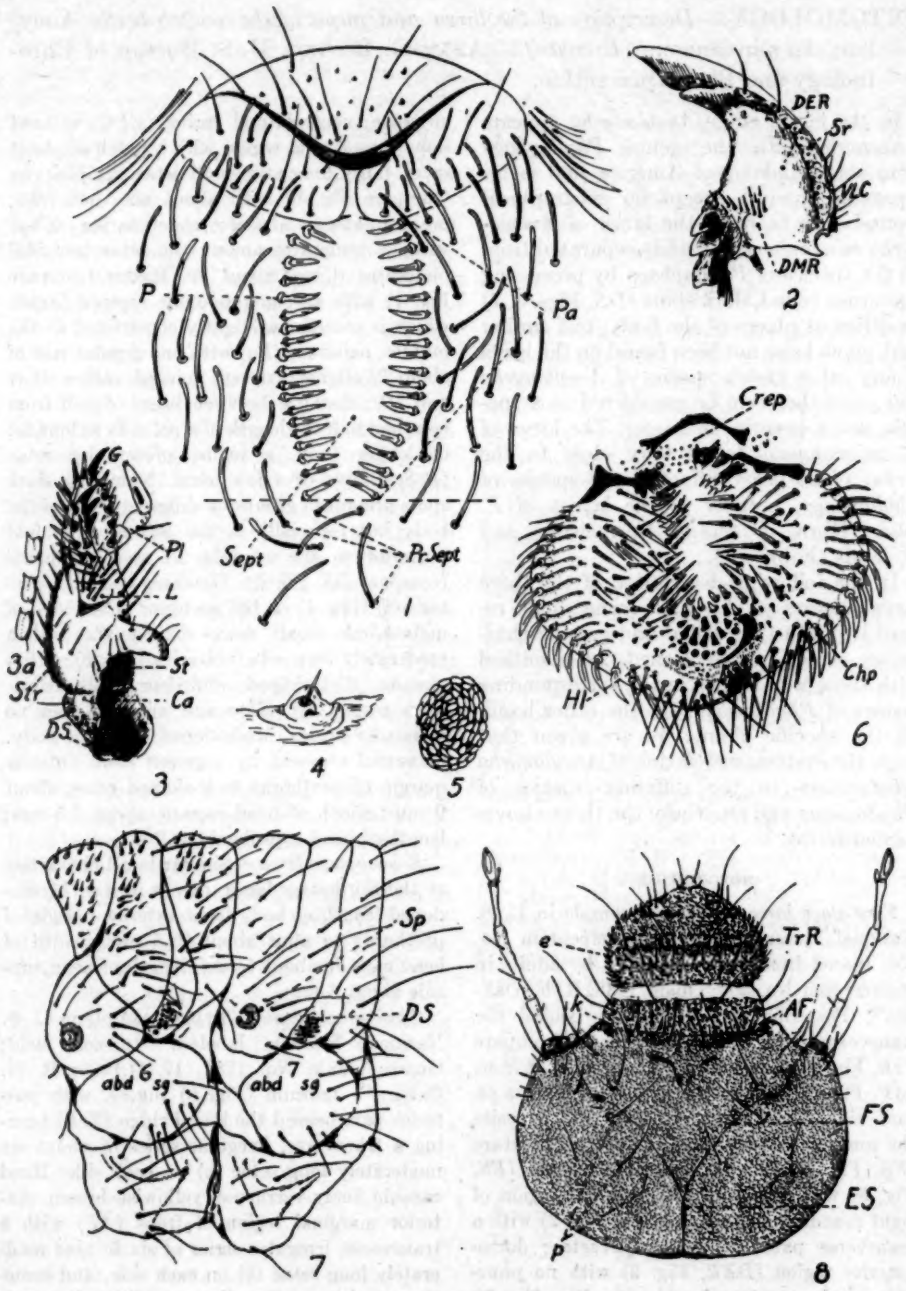
DESCRIPTION

First-stage larva.—(Typical sample in U. S. National Museum labeled: "Interception No. 556, reared from eggs oviposited by adults in Interception No. 554; Guam 1938. R. G. Oakley.") Posterior part of labrum behind the transverse labral ridge without setae (compare *TrR*, Fig. 8). Anterior marginal region of frons (*AF*, Fig. 8) with one moderately long seta on each side. Epicranium on each side opposite the concave posterior part of the frontal suture (*FS*, Fig. 8) and the epicranial suture (*ES*, Fig. 8) with two setae. Dorsomolar region of right mandible (compare *DMR*, Fig. 2) with a transverse patch of about 12 setae; dorsoexterior region (*DER*, Fig. 2) with no punctures and no setae; scrobis (*Sr*, Fig. 2) with about 10 punctures in a longitudinal row and no setae; ventrolateral carina (*VLC*) without setae; basolateral region with a patch of about seven fairly long and small setae. Epipharynx (compare Fig. 6) with about nine heli (*Hl*); proplegmatium absent; chaetopariae (*Chp*) without punctures among the setae; crepidal punctures (*Crep*) about 20. Raster (compare Fig. 1) with an elongate-ovate septula (*Sept*), which is sometimes slightly constricted at the middle; palidium (*Pa*) with one regular row of about 25 slightly curved, pointed, rather short pali (*P*); distance between bases of pali from less than half the length of a palus to as long as, or longer than, a palus; preseptular setae (*PrSept*) five or a few more. Numerous dark spots present in groups on different parts of the body but especially in the bottom of a fold posterior to the spiracles of most segments (compare *DS*, Fig. 7). Hatching tooth (=ruptor ovi) (Fig. 4) on the posterior dorsal area of metathorax, small, dome shaped, and with a moderately long seta. Spiracles (Fig. 5) with a circular, disk-shaped, multifenestrate, cribriform respiratory plate and no bulla and no spiracular orifice. Mediodorsal length of body, measured segment by segment from anterior margin of prothorax to V-shaped anus, about 9 mm; width of head capsule about 2.5 mm; length of head capsule about 2 mm.

Second-stage larva.—Similar in all characters to the third-stage larva, except in size. Mediodorsal length of body from anterior margin of prothorax to anus about 28.5 mm; width of head capsule about 5 mm; length of head capsule about 3 mm.

Third-stage larva.—(Typical sample in U. S. National Museum labeled: "In soil, field; Guam; Guam No. 1784; 17.III.1939; R. G. Oakley.") Labrum (Fig. 8) rugose, with posterior part behind the labral ridge (*TrR*) bearing a transverse, irregular series of about six moderately long setae (*e*) on each side. Head capsule finely verrucose, yellowish brown. Anterior marginal region of frons (*AF*) with a transverse, irregular series of six to nine moderately long setae (*k*) on each side (and sometimes with a few short additional setae). Epicranium (Fig. 8) on each side opposite the concave posterior part of one of the frontal

[1] Received October 4, 1944.



FIGS. 1–8 —*(See opposite page for legend)*

sutures (*FS*) and the epicranial suture (*ES*) with a somewhat oblique, longitudinal series of three setae (*p*) of various lengths. Dorsomolar region (*DMR*, Fig. 2) of right mandible with a transverse patch of about 12 setae, dorsoexterior region (*DER*) with no punctures and no setae; scrobis (*Sr*) without setae but with several longitudinally arranged sensorial punctures distributed over most of the surface and in the wall of the carinae, which limit the region; ventrolateral carina (*VLC*) with about 10 moderately long setae; basolateral region with a patch of about 10 fairly long setae. Epipharynx (Fig. 6) with about nine heli (*Hl*); proplegmatium absent; chaetoparіae (*Chp*) without sensorial punctures among the setae; crepidal punctures (*Crep*) about 20. Raster (Fig. 1) with elongate-ovate septula (*Sept*); palidium (*Pa*) with one regular row of from 20 to 27 depressed, straight, dagger-shaped, pointed and (when not worn) moderately long pali (*P*); distance between bases of pali about half as long as, or considerably shorter than, length of a palus; preseptular setae (*PrSept*) six or a few more or less. Claws unequal in length and different in shape on the three pairs of legs; on first and second pairs of legs about one-third length of tibiotarsi, enlarged at bases, straight and distally pointed; on third pair of legs less than half as long as claws of first and second pairs of legs, at base enlarged and distinct but distally very short. Spiracles (*Sp*, Fig. 7) well developed, each with the respiratory plate C-shaped, surrounding more than three-fourths circumference of bulla, and with an open, curved, spiracular orifice; minute fenestral elements of cribriform respiratory plate oval and arranged in numerous transverse series with about 20 in each series; thoracic spiracle one and one-half times as large as the first abdominal spiracle; abdominal spiracles decreasing slightly and gradually in size posteriorly. Mediodorsal length of body, measured segment by segment from anterior margin of prothorax to the simple V-shaped anus, 42.5 mm; width of head 6 to 6.2 mm; length of head 4 mm.

Pupa.—Body soft-skinned, free from vestitures, all segments without lateral expansions. Mesonotum and metanotum slightly grooved longitudinally in the middle line; scutellum distinct. Base of each elytron with a thornlike, conical projection. Dorsal portion of each of the anterior abdominal segments rounded, but dorsal portions of the last three segments more flattened and with obtusely waved wrinkles; posterior margin of dorsum of each of fourth and fifth abdominal segments furnished with a pair of paramedian, dark, flat, dorsally convex knobs. Pleura of abdominal segments fused with their ventral parts. Cerci rather slender, conical, glabrous, directed obliquely backward and extenuated into a corneous, incurved, sharply pointed hook; each cercus about five times as short as one of the sides of the ninth abdominal segment. Anterior four pairs of abdominal spiracles provided each with a slightly tubular, rather thick and dark peritrema; rest of abdominal spiracles without distinct and dark peritremata. Mediodorsal length of pupa, measured from middle of vertex to posterior end of abdomen (excluding the cerci), about 28 mm; greatest width of prothoracic shield about 8 mm.

FIGS. 1–8.—LARVA OF ANCYLONYCHA MINDANAONA (BRENSKE)

The drawings for the figures were made by the author. When a figure presents a dorsal view of a structure the front part of the structure is shown pointing toward the upper margin of the plate, but when a figure gives a ventral view it is the rear part which points toward the upper margin. The right and left sides of the structure as they appear on the figure will then correspond to the veritable right and left sides of the structure in natural position on the insect when the latter is seen from above with its head away from the observer.

FIG. 1.—Raster: *P*, palus; *Pa*, palidium; *PrSept*, preseptular setae; *Sept*, septula. FIG. 2.—Right mandible, dorsal view: *DER*, dorsoexterior region; *DMR*, dorsomolar region; *Sr*, scrobis; *VLC*, ventrolateral carina. FIG. 3.—Left maxilla (facing the cavity of the mouth): *Ca*, cardo; *DS*, dark spots; *G*, galea; *L*, lacinia; *Pl*, palpus; *St*, stipes; *Str*, stridulatory teeth. FIG. 3a.—Stridulatory teeth. FIG. 4.—Hatching tooth (ruptor ovi). FIG. 5.—Spiracle of first-stage larva. FIG. 6.—Epipharynx, ventral view: *Chp*, chaetoparia; *Crep*, crepidal punctures; *Hl*, helus. FIG. 7.—Sixth and seventh abdominal segments, lateral view: *DS*, dark spots; *Sp*, spiracle. FIG. 8.—Dorsal surface of head: *AF*, anterior marginal region of frons (with 6 to 9 setae, *k*, on each side); *ES*, epicranial suture; *FS*, frontal suture (*p*, oblique longitudinal series of 3 setae opposite and close to the concave posterior part of frontal suture and the epicranial suture); *TrR*, posterior transverse labral ridge (*e*, transverse series of about 6 setae on each side behind the ridge).

ENTOMOLOGY.—*Five mites of the family Ereynetidae from Mexico.*[1] EDWARD W. BAKER, Bureau of Entomology and Plant Quarantine. (Communicated by ALAN STONE.)

The mites of the family Ereynetidae are prostigmatic and in addition are characterized by the two pairs of long, finely pilose, sensory hairs, one pair on the thorax and the other on the rear of the abdomen; by the 3- or 5-segmented palpus; and by the presence of two pairs of genital cups. Most of the species are known from Europe, the majority of these being parasites or "pseudoparasites" on snails and insects, although some are found in moss or on plants. Of the five species presented in this paper, one is already known from snails in Holland, while the others appear to be new. Type slides, as well as a slide of the snail-inhabiting species, have been deposited in the United States National Museum, Washington, D. C.

Genus **Riccardoella** Berlese
Riccardoella oudemansi Sig Thor

Fig. 1

Riccardoella oudemansi Sig Thor, Zool. Anz. 99: 249, figs. 1–17, 1932; Das Tierreich 60: 63, figs. 71–87, 1933.

(Description after Sig Thor, 1933. Translated by the author.) Body broad, egg-shaped, rounded, not segmented. Color yellowish or reddish white, with a broad dorsal stripe. Skin with fine tuberculated striations. Hairs short, stiff, thick, and finely pilose. Rostrum short, broad, sharpened triangularly to tip, with two pairs of very short, pilose hairs. The 3-segmented, short palpus has short, relatively thick segments, the end segment with four short, pilose hairs. Thorax without eyes or chitinous plates but with the usual four pairs of hairs; between the two long sensory hairs the usual setae, and close anteriorly a pair of very small hairs; thoracic shoulder hairs longer, the 14 abdominal hairs of the usual arrangement and size. Few hairs ventrally; five pairs of small genital hairs, and five pairs of longer hairs more laterally. Two pairs of round genital cups. Anal opening indistinct (easily seen in Mexican material). Epimera of medium size, with one to three pairs of hairs; the two anterior pairs of epimera have a single bent chitinous rod or plate. The legs relatively thick and short, about 200–240μ long, with few pilose hairs. On the tarsi many flat, leaflike, pilose hairs; a small clavate seta on tarsi I and II; two weak claws and a pilose tarsal pad. Length about 360–400μ, width 224–280μ.

In Holland the mite was taken on *Limax* sp. In Mexico, D. F., the mites were found in some abundance running over the slimy part (the foot) of the snail *Helix pomatia* Linnaeus, which is European in origin. The mites were taken December 4, 1943.

Genus **Opsereynetes** Sig Thor
Opsereynetes simplexus, n. sp.

Fig. 2

Female.—Of medium size; thoracic furrow entire in fresh mounts; amber colored, with a lighter dorsal stripe and lighter legs and beak. Striations typical. Rostrum of normal size; venter with a pair of pilose hairs out under segment I of palpus, and a posterior pair of pilose hairs. Second mandibular segment long, narrow, slightly curved. Palpus of normal length, segment III reaching to about tip of rostrum, 22μ long and 16μ wide, with two pilose hairs about as long as segment IV; segment IV 11μ long and 9μ wide, rounded, with two pilose hairs about length of segment; segment V 10μ long and 5.5μ wide, constricted toward tip, with two pilose lateral hairs and a simple strong end hair. Cephalothorax with a pair of large eyes just outside and slightly anterior to the thoracic sensory hairs; all body hairs pilose; thoracic sensory hairs 83μ long; the tiny pair of hairs just anterior to the sensory setae 5.5μ long; longer pair 16.6μ long, between the sensory setae. No chitinous shields seen. Dorsal abdominal hairs 19.5μ long; posterior abdominal sensory setae 75μ long. Anal opening on rear. Genital opening of female with five pairs of pilose hairs. Legs normal; legs I, III, and IV about 166μ long, leg II 133μ long; all leg hairs pilose, those on tarsi strong; tarsus I with a small, broad, clavate seta; tarsus II with a narrow clavate seta. Tarsal pads with hairs. Length with rostrum 266μ, width about 100μ.

[1] Received September 18, 1944.

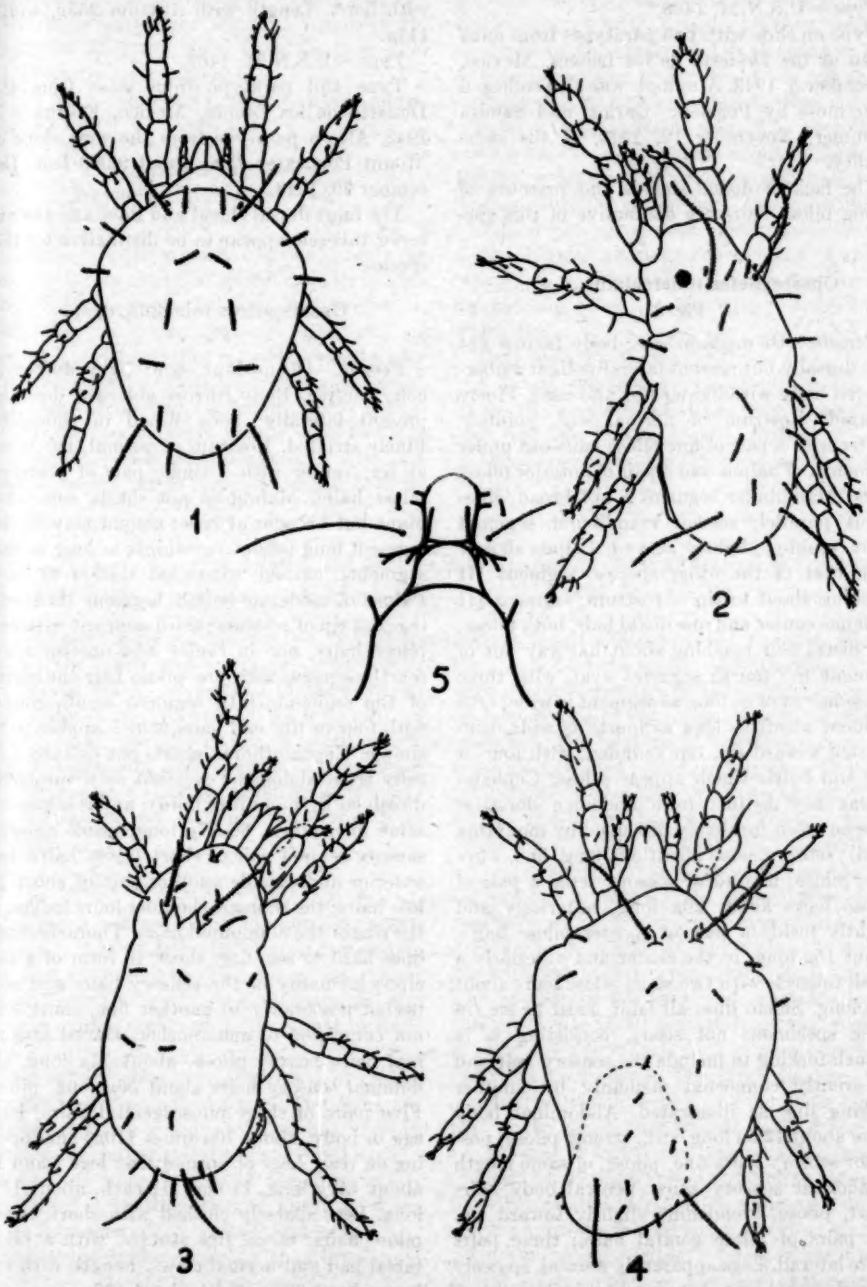


FIG. 1.—*Riccardoella oudemansi* Sig Thor, adult. FIG. 2.—*Opsereynetes simplexus*, n. sp., adult. FIG. 3.—*Opsereynetes tuberculatus*, n. sp., adult. FIG. 4.—*Opsereynetes robustus*, n. sp., adult. FIG. 5.—*Ereynetes sabinensis*, n. sp., camera-lucida drawing of dorsal shield.

Type.—U.S.N.M. 1468.

Type on slide with two paratypes from moss taken at the Desierto de los Leones, Mexico, December 5, 1943. A nymph was also collected from moss by Penelope, Carlos, and Sandra Plummer, November 19, 1943, at the same locality.

The lack of dorsal shields and presence of strong pilose hairs are distinctive of this species.

Opsereynetes tuberculatus, n. sp.

Fig. 3

Female.—Of medium size; body furrow not seen dorsally but present laterally; light amber-colored body with lighter legs and beak. Finely striated. Rostrum of normal size, pointed; venter with a pair of fine pilose hairs out under segment I of palpus and a pair of anterior pilose hairs. Mandibular segment I not broad, sides about parallel; second mandibular segment short, stubby, slightly curved. Palpus shorter than that of the other species, segment III reaching about to tip of rostrum; segment III with one center and one distal hair, both pilose, the distal hair reaching about halfway out of segment IV; fourth segment oval, with three pilose hairs not so long as segment is wide; fifth segment about as long as fourth is wide, constricted toward tip, but rounded, with four or five end hairs, which appear pilose. Cephalothorax not distinct from abdomen dorsally; eyes not seen (probably dissolved by mounting fluid); sensory setae about 50μ long, fine, wire-like, pilose; laterad of sensory setae a pair of pilose hairs about 20μ long; anteriorly and slightly inside a pair of shorter pilose hairs, about 15μ long; in the center and anteriorly a small tubercle with two short pilose hairs about 10μ long. Shield lines all faint, hard to see (in some specimens not seen), consisting of a branch forking to include the sensory hair and apparently connected medianly by another forking line as illustrated. Abdominal body hairs about 12.5μ long, stiff, strong, pilose; posterior sensory hairs fine, pilose, of same length as thoracic sensory hairs. Ventral body hairs short, pilose, broadening slightly toward tip. Six pairs of pilose genital hairs; three pairs more laterad. Legs apparently normal, sparsely haired with blunt, heavy, short, pilose setae; length of legs: I, 166μ; II and III, each 133μ; IV, 155μ; tarsus not blunt at tip; tarsal pads with hairs. Length with rostrum 255μ, width 111μ.

Type.—U.S.N.M. 1469.

Type and paratype from moss from the Desierto de los Leones, Mexico, February 7, 1943. Also a paratype from the west slope of Mount Popocatepetl at about 9,000 feet, December 29, 1943.

The faint dorsal shield and lines and the anterior tubercle appear to be distinctive for this species.

Opsereynetes robustus, n. sp.

Fig. 4

Female.—Of medium size; light amber in color; active. Body furrow not seen dorsally, present laterally; body broad in shoulders. Finely striated. Rostrum of normal size blunt at tip; venter with a single pair of posterior pilose hairs. Mandibles not sharp, somewhat blunt but broader at base; second mandibular segment long (about two-thirds as long as first segment), curved, somewhat thicker at base. Palpus of moderate length, segment III reaching past tip of rostrum; third segment with two pilose hairs, one in center and one on apex; fourth segment with one pilose hair the length of the segment; fifth segment small, round, with four or five end hairs, which appear to be simple. Cephalothorax short, not defined dorsally from abdomen; eyes not seen (probably dissolved by mounting fluid); anterior sensory setae fine, pilose, 66–77μ long; inside anterior sensory setae a pair of short pilose hairs, and anterior and outside another pair of short pilose hairs; the thoracic shoulder hairs longer, of the size of the abdominal hairs. Thoracic shield lines hard to see, fine, short, in form of a half circle medianly of the sensory hairs and connected posteriorly to another fine, short line; not connected to one another. Dorsal abdominal hairs heavy, pilose, about 14μ long; abdominal sensory hairs about 56μ long, pilose. Five pairs of short pilose genital hairs; large egg in body, about 70μ times 110μ; anal opening on rear. Legs of normal size: legs I and IV about 157μ long, II and III each, about 135μ long. Legs sparsely clothed with short, blunt, pilose hairs; tarsal tips stubby, with a pilose tarsal pad and normal claws. Length with rostrum about 292μ, width about 157μ.

Type.—U.S.N.M. No. 1470.

The type was found in moss collected by

Penelope, Carlos, and Sandra Plummer at the Desierto de los Leones, Mexico, November 19, 1943. The allotype (male) is on the type slide for *Ereynetes tuberculatus*, n. sp.

The body shape and the dorsal lines are distinctive.

Genus **Ereynetes** Berlese

Ereynetes sabinensis, n. sp.

Fig. 5

Female.—Medium sized; color not known, as described from mounted specimen. Finely striated. Rostrum somewhat long and narrow in proportion to body; venter with a pair of medium-length posterior pilose hairs and a pair of shorter anterior pilose hairs. Second mandibular segment of medium length, curved. Palpus slender; segment III slender, with two medium-length pilose hairs; segment IV with one medium-length pilose hair, segment V hard to see but with several apparently simple hairs. Cephalothorax with dorsal chitinous pattern as shown by the camera-lucida drawing in Fig. 5, anterior portion either weakly or not at all connected. Thoracic sensory setae fine, pilose, about 78μ long; shoulder hair 25.5μ long; thoracic setae on shield pattern about 12.7μ long, the hairs anterior to these about half that length; all pilose and strong. Abdominal hairs about 16.6μ long, strong, pilose; posterior abdominal hairs shorter. Seven pairs of short, strong, pilose genital hairs. Legs normal; leg hairs strong, pilose. Length with rostrum 288μ, width 122μ.

Type.—U.S.N.M. No. 1471.

A single female was collected by Dr. F. Bonet in bat guano in the Cueva de los Sabinos, San Luis Potosí, April 3, 1942.

The thoracic shield pattern appears to be distinctive.

ZOOLOGY.—*A new starfish of the genus* Luidia *from the coast of Georgia.*[1] AUSTIN H. CLARK, U. S. National Museum.

The genus *Luidia*, represented in all seas except the polar and subpolar, includes 45 species, of which nine occur in the western Atlantic, chiefly in the Tropics, two of these ranging to west Africa. The discovery of a well-marked new species of this genus in a region so well known as the southeastern United States is a matter of no little interest.

Luidia bernasconiae, n. sp.

Diagnosis.—A species of the *alternata* group (subgenus *Alternaster*) with 5 arms, numerous long and prominent paxillar spines, the actinal intermediate plates with pedicellariae, and the lateral paxillae each with a prominent pedicellaria.

Description.—R = 100 mm; r = 10 mm; breadth of ray at base 12 mm. The arms are slender, tapering evenly to a rather sharply rounded tip, rather thick, the abactinal surface flat and the sides, formed of the three outermost rows of paxillae, sloping abruptly down to the inferomarginals, as in *L. alternata*.

Above the inferomarginals there are three regular longitudinal rows of paxillae arising from quadrilobate plates; these paxillae form regular transverse as well as longitudinal rows, each transverse row corresponding to an inferomarginal. The paxillae of the two outermost rows are similar, rather small, each isolated from its neighbors. The crown is more or less convex and bears about 15 rather stout cylindrical spinules with rounded tips, the length of which is slightly greater than the diameter of the crown. In addition to the spinules each paxilla bears on the distal side a conspicuous stout pedicellaria slightly longer than the spinelets with two or three, very rarely four, valves. The paxillae of the third row alternate large and small. The small paxillae resemble those of the two outer rows, and each bears a conspicuous stout pedicellaria. The large paxillae, the diameter of which is two or even three times that of the small, bear a stout pointed central spine 3 mm in length the base of which is surrounded by 25 or 30 spines resembling those of the other paxillae, arranged in a complete outer and more or less incomplete inner row.

On the aboral surface between these three lateral rows on either side the paxillae are irregular in arrangement, smaller and lower, and arise from polygonal, often 5-sided, bases.

[1] Published by permission of the Acting Secretary of the Smithsonian Institution. Received October 4, 1944.

In the middle third of the arm they are composed of one to four much swollen club-shaped spinules, which are surrounded by seven to nine spinules of the usual type. The paxillae on the outer borders of this median band, which are larger and intergrade with the lateral paxillae, carry pedicellariae, and some of them bear long central spines. Spines therefore occur in a continuous row along the dorsolateral border of the arms, with a partial row borne on the adjacent paxillae and a few on the next, very irregular, paxillar row. The paxillae of the middle third of the arms do not bear spines or pedicellariae.

The paxillae of the central portion of the disk are small, like those of the midline of the arms, but intermixed with these are a dozen or so larger ones bearing spines of various sizes.

In a general view of the aboral surface the paxillae do not form a continuous and unbroken covering studded with numerous granules (the broadly rounded tips of the spinules) as in *L. alternata* and in *L. numidica;* the paxillae are more or less distinctly separated from each other so that each appears individually, the papular pores between them being, except in the center of the disk, everywhere more or less clearly visible.

The inferomarginal plates are narrow, and the fasciolar channels between them are deep and about as broad as the high intervening ridges. Each plate bears a stout regularly tapering spine about 4 mm long near its outer end, with frequently a similar though usually somewhat smaller spine below it. Occasionally the outer spine is smaller than the inner. The center of the ridge is occupied by four to six stout sharp spinules, the longest 1.5 to 2 mm in length, which are somewhat irregularly arranged and are flanked by similar but shorter and slenderer spinules. These spinules are all well separated from one another.

Each adambulacral plate bears a long, curved, and flattened furrow spine about 1.5 mm long. This is followed by a straight or slightly curved spine nearly 3 mm long, and this is turn by a similar but shorter and slenderer spine that has a much smaller spine situated at its base on the adoral side. The first two adambulacral plates on each side of the mouth plates each bear a very large 3-bladed pedicellaria (rarely two); these pedicellariae are larger than those on the adjacent actinal intermediate plates. None of the other adambulacral plates carry pedicellariae.

Throughout most of the length of the arms the actinal intermediate plates project in the form of a thick column resembling the stalk of a paxilla between the outer ends of the adambulacrals and the inner ends of the inferomarginals. This column is surmounted by a large conical pedicellaria 2.5 to 3 times as long as broad at the base and about 1.25 mm high with three slender jaws. Just beneath this pedicellaria on the adoral side is a very slender spinule the length of which is one-fourth to about one-half that of the pedicellaria, and there are usually from one to several similar spinules elsewhere about the summit of the column. These large pedicellariae continue to within about 15 mm of the tips of the arms, where they disappear and the plates become inconspicuous.

In the interbrachial areas about the mouth there are four actinal intermediate plates in addition to those of the complete row, each of which bears a large 3-valved pedicellaria and beneath it a circlet of about five long slender spinules.

The narrow mouth plates each bear a marginal row of four long and stout spines, which resemble those on the adjacent adambulacrals but are slightly smaller; the two innermost spines are usually slightly larger than the others. In addition to these large spines there are numerous spinules, but no pedicellariae.

The color, dried from alcohol, is uniform white tinged with pale brownish gray.

Type.—U.S.N.M. E.6718; from between 60 and 100 miles off the Sea Islands, Ga.; collected by William W. Alexander, August 6, 1931.

It gives me great pleasure to dedicate this new species to Miss Irene Bernasconi, the talented custodian of echinoderms in the Museo Argentino de Ciencias Naturales, Buenos Aires.

Comparisons.—This new species is a member of the *alternata* group of *Luidia*, the 19 members of which are distributed throughout the warmer portion of the oceans, occurring from the shore line down to 380 meters, though most of them live in shallow water. Six species of this group were heretofore known from the Atlantic, one, *numidica*, from west Africa, the other five, *alternata*, *barbadensis*, *convexiuscula*, *quequenensis*, and *variegata*, from tropical and

subtropical America, chiefly from the Caribbean region. Two of these species, *barbadensis* and *convexiuscula*, have six arms and need not be further considered. From *alternata* this species differs in the smaller paxillae with stouter spinules and in the occurrence of pedicellariae on the paxillae of the lateral portions of the arms. From *variegata* and *quequenensis* it differs in the presence of pedicellariae on the lateral paxillae, and in the fewer and more localized spine-bearing paxillae. In the presence of numerous pedicellariae on the lateral paxillae, in the character of the paxillae, and in the form of the pedicellariae on the actinal surface it agrees with the west African *numidica*. It appears to differ from *numidica* in having the spines on the abactinal surface more numerous, longer, and more slender, the abactinal pedicellariae more regular and more numerous, and the paxillae in the midline of the arms smaller with less diversified spinelets. It is without doubt the American representative of *numidica*.

ZOOLOGY.—*Notes on some recently collected hydroids in the United States National Museum, with descriptions of three new species.*[1]

C. MCLEAN FRASER, University of British Columbia. (Communicated by WALDO L. SCHMITT.)

A small assemblage of hydroids from the United States National Museum, recently collected, is made up of three lots: a collection made off the coast of South Carolina, Georgia, and northern Florida by the *Pelican*, February, 1938, to February, 1940; a collection made from the lower Potomac oyster bars in December, 1942, and January, 1943; and a collection from the Louisiana State University, obtained off the Florida and Louisiana coast in the summers of 1942 and 1943, respectively.

Although only 13 species were obtained, most of them common, the collections were not lacking in interest. Three of the species appear to be new, and the known range of each of three others was extended. Two of the new species were from the *Pelican* collection and the other one from the Louisiana collection. Of the species of which the range was extended, two were from the *Pelican* collection and one from the lower Potomac.

I wish to express my indebtedness to the United States National Museum for again making available to me for study interesting hydroid material, and also to Miss Marian McCrea, of Vancouver, who has made the enlarged drawings used in illustration.

SPECIES FROM THE *Pelican* COLLECTION

Halecium gracile Verrill. Station 182–16; lat. 32°53′ N., long. 79°30′ W., 5 fathoms.

Synthecium tubithecum (Allman). Station 181–13, lat. 32°03′ N., long. 79°49′30″ W., 14 fathoms.

Monostaechas quadridens (McCrady). Blackfish Bank, S. C., depth not given.

Aglaophenia acacia Allman. Station 181–14, lat. 32°03′30″ N., long. 79°45′30″ W., 16 fathoms; station 183–11, lat. 33°40′ N., long. 78°13′30″ W., 9 fathoms. The only previous records in the western Atlantic for this species are for off North Carolina. These records extend the range southward to Savannah, Ga.

Aglaophenia aperta Nutting. Station 13, lat. 29°20′ N., long. 88°16′ W., 33 fathoms; station 14, lat. 29°20′ N., long. 88°28′ W., 30½ fathoms. There are two previous records of this species, both off Habana, the one in 194 fathoms, the other in 200. These records extend the known range some distance to the northward and into much shallower water.

Aglaophenia longiramosa, n. sp. Station 142–5. lat. 29°58′ N., long. 88°03′ W., 16 fathoms.

Cladocarpus longipinna, n. sp. Station 13, lat. 29°20′ N., long. 88°16′ W., 33 fathoms.

SPECIES FROM LOWER POTOMAC OYSTER BARS

Bimeria tunicata Fraser. Station 19, Lower Cedar Point Bar. This record extends the known range of this species very considerably, as all previously recorded specimens were obtained off the coast of Louisiana.

Clytia longicyatha (Allman). Station 1, Sheepshead Bar; 3, Cords Flats Bar; 13, Higgins Point Bar; 15 and 16, Sheepshead Bar; 18, Heron Island Bar. This must be the common species in this area, since it appeared in all the stations but one from which hydroids were collected.

[1] Received October 18, 1944.

Thuiaria argentea (Linnaeus). Station 13, Higgins Point Bar.

SPECIES FROM LOUISIANA STATE UNIVERSITY
(Presumably all littoral)

Bougainvillia inaequalis Fraser. Front Beach, Grand Isle, La.

Eudendrium speciosum, n. sp. Santa Rosa Sound, Pensacola, Fla.

Aglaophenia late-carinata Allman. Grand Isle, La.

Eudendrium speciosum, n. sp.
Fig. 1

Trophosome.—Colony erect, 4–5 cm, with a continuous main stem, nearly straight, with several branches varying very much in length; the larger ones are branched again; there is a tendency to alternation, but it is rather irregular. The main stem is practically free of annulation, although somewhere in its length there may be a single series of two or three annulations; none appears above the origin of the branches. Each branch has rather an abrupt bend near the base, and the base appears to be set on the stem rather than to be growing from it. Each branch and pedicel has four or five annulations at the base, but otherwise the surface is smooth; even in the larger branches annulations appear only at the base. The hydranth is handsome, with about 25 long, slender tentacles.

Gonosome.—Male gonophores, bithalamic, are arranged in a single whorl around the base of the hydranth which is not at all aborted. Female gonophores were not observed.

Type.—U.S.N.M. 43464.

Aglaophenia longiramosa, n. sp.
Fig. 2

Trophosome.—Colony stout, 15 cm, consists of a main stem and several long branches that grow outward at an acute angle with the stem and pass along in much the same direction as the stem, to look like a portion of the stem itself; both stem and branches are fascicled. The hydrocladia are given off alternately from both stem and branches; they are long, up to 2 cm or even more; they are divided into short internodes, but at times the nodes are not so pronounced as the internal septa, of which there are two to each internode; the one nearly opposite the intrathecal septum is strongly marked; the other, just below the supracalycine nematophore, is not so distinct; sometimes it scarcely shows. The hydrotheca is about 1½ times as long as wide, projecting outward at an angle of 15°, and with the margin comparably oblique; the face is nearly straight; the intrathecal ridge is well marked, horizontal, and complete, slightly lower than the corresponding internodal septum. There are seven marginal teeth; the median tooth is small and rather sharp, the first lateral is slightly larger and blunter, the other two laterals are broader and rounded at the tip. The supracalycine nematophore is curved, reaching beyond the margin of the hydrotheca; the mesial nematophore is almost as long as the face of the hydrotheca; only a small, somewhat shovel-shaped portion is free.

Gonosome.—Not observed.

Type.—U.S.N.M. 43463.

Cladocarpus longipinna, n. sp.
Fig. 3

Trophosome.—Fragment of colony, 4 cm, was not branched; stem fascicled; hydrocladia up to 2 cm in length, slender, divided into long internodes that are strongly septate, usually eight or nine septa present. The hydrotheca is long and slender, gradually increasing in size from base to margin; face slightly convex; the intrathecal ridge is short, turned upward; the margin is horizontal. There is one short median tooth much longer than the others, of which there are six pairs, shallow and rounded to produce a wavy appearance. The supracalycine nematophores overtop the margin of the hydrotheca; the mesial nematophore is short, with the base adherent to the internode below the hydrotheca and the short free portion projecting out past the base of the hydrotheca; there is a definite joint at the base.

Gonosome.—The gonangia are oblong, with the tip curved over, and the opening pointing outward or downward; they grow in large numbers from the bases of the hydrocladia and from the stem nearby. The phylactogonia are of the staghorn type with two prongs, each regularly curved, with usually four points to each prong.

Remarks.—This species closely resembles *C. septatus* Nutting. It differs from it in having a fascicled stem, a longer and slenderer hydrotheca, with a greater number of small teeth on the margin, and in having simpler phylactogonia.

Type.—U.S.N.M. 43465.

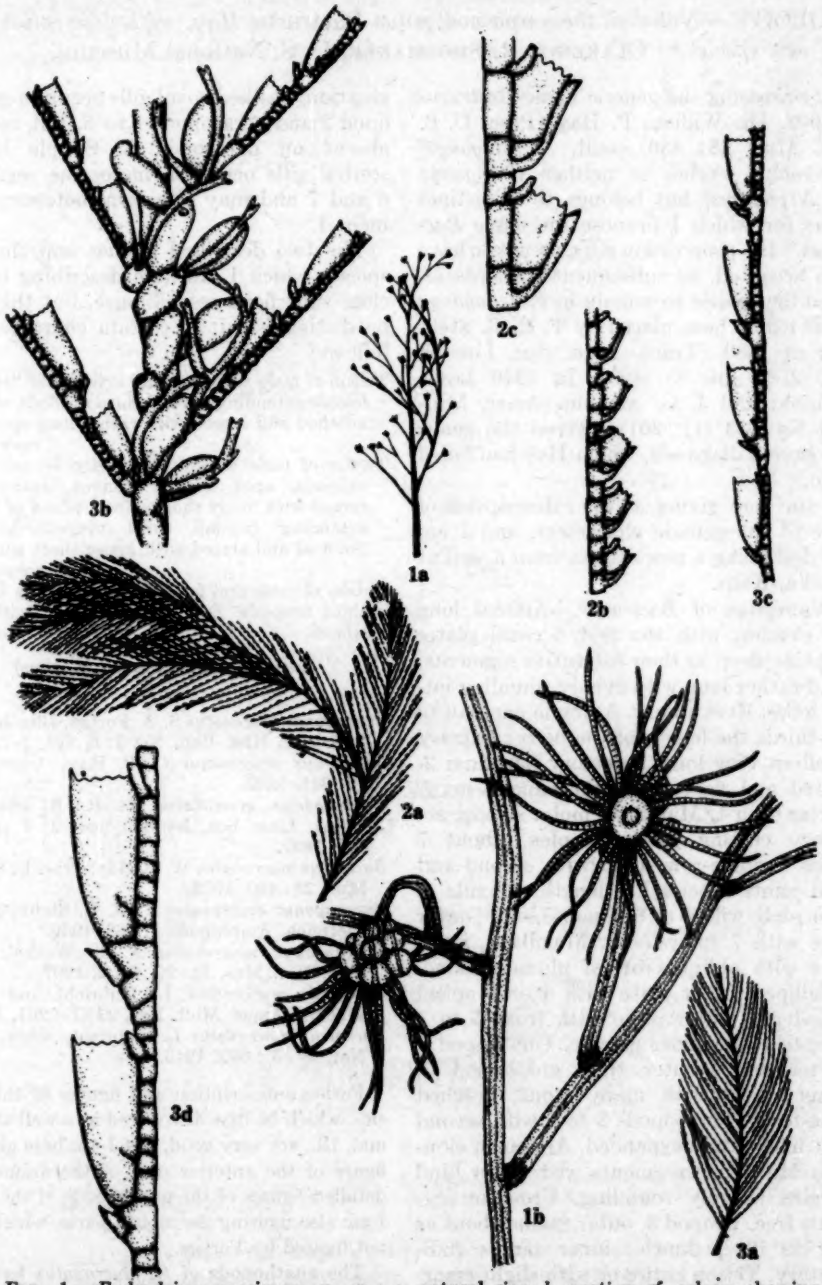


FIG. 1.—*Eudendrium speciosum*, n. sp.: *a*, natural size; *b*, portion of colony showing hydrothecae and male gonophores (×20). FIG. 2.—*Aglaophenia longiramosa*, n. sp.: *a*, natural size; *b*, portion of hydrocladium with hydrothecae (×20); *c*, portion of hydrocladium with hydrothecae (×40). FIG. 3.—*Cladocarpus longipinna*, n. sp.: *a*, natural size; *b*, portion of colony showing hydrothecae, gonangia, and phylactogonia (×20); *c*, portion of hydrocladium with hydrothecae (×20); *d*, two hydrothecae (×40).

ZOOLOGY.—*Notes on the amphipod genus* Bactrurus *Hay, with description of a new species.*[1]

CLARENCE R. SHOEMAKER, U. S. National Museum.

In proposing the generic name *Bactrurus* in 1902, Dr. William P. Hay (Proc. U. S. Nat. Mus. **25**: 430) said, *"C[rangonyx] mucronatus* Forbes is neither *Crangonyx* nor *Niphargus*, but belongs to a distinct genus for which I propose the name *Bactrurus."* His proposition appears not to have been accepted, as subsequent students allowed the species to remain in *Eucrangonyx* where it had been placed by T. R. R. Stebbing in 1899 (Trans. Linn. Soc. London (ser. 2) **7** (pt. 8): 423). In 1940 Leslie Hubricht and J. G. Mackin (Amer. Midland Nat. **23** (1): 201) revived the genus and gave a diagnosis, which Hay had failed to do.

I am here giving a fuller description of some of the generic characters, and I am also describing a new species from a well at Topeka, Kans.

Description of Bactrurus.—Animal long and slender, with the first 4 coxal plates about as deep as their respective segments. Head rather long with evenly rounding lateral lobes. Eyes absent. Antenna one-half to two-thirds the length of the body; primary flagellum very long, accessory flagellum 2-jointed and very short. Antenna 2 much shorter than 1. Mandible, molar strong, accessory cutting plate complex, about 7 spines in spine-row, palp with second and third joints subequal in length. Maxilla 1, inner plate with 5 or 6 plumose setae; outer plate with 7 spine-teeth. Maxilla 2, inner plate with oblique row of plumose setae. Maxilliped, inner plate with 4 or 5 apical spine-teeth; outer plate with from 5 to 7 spine-teeth on inner margin. Gnathopod 1 shorter and stouter than gnathopod 2, palms armed with many stout, notched spine-teeth. Peraeopods 3 to 5 with second joint moderately expanded. Abdomen elongate. Metasome segments with lower hind margins broadly rounding. Urosome segments free. Uropod 3, outer ramus about as long as its peduncle; inner ramus rudimentary. Telson entire or with slight emargination. Stalked coxal gills occur on gnathopod 2 and peraeopods 1 to 5, but may be absent on peraeopod 5. Simple lateral sternal gills occur on mesosome segments 6 and 7 and may occur on metasome segment 1.

The two described species and the new species which I am here describing bear a close superficial resemblance, but they can be distinguished by certain characters, as follows:

Telson of male very long and cylindrical; telson of female extending beyond third uropods, slightly notched and armed with rather long spines. *mucronatus*

Telson of male extending slightly beyond third uropods, apex slightly convex, entire, and armed with many short spines; telson of female extending beyond third uropods, slightly notched and armed with many short spines. *brachycaudus*[2]

Telson of male and female not extending beyond third uropods, notched and armed with long spines. . . . . *hubrichti*

Bactrurus mucronatus (Forbes)

Fig. 1

Crangonyx mucronatus S. A. Forbes, Illinois State Lab. Nat. Hist. Bull. No. 1: 6, figs. 1–7. 1876.
Crangonyx mucronatus O. P. Hay, Amer. Nat. **16**: 241. 1882.
Eucrangonyx mucronatus T. R. R. Stebbing, Trans. Linn. Soc. London (ser. 2) **7** (pt. 8): 423. 1899.
Bactrurus mucronatus W. P. Hay, Proc. U. S. Nat. Mus. **25**: 430. 1902.
Eucrangonyx mucronatus T. R. R. Stebbing, Das Tierreich, Amphipoda I: 388. 1906.
Eucrangonyx mucronatus A. L. Weckel, Proc. U. S. Nat. Mus. **32**: 29, fig. 2. 1907.
Bactrurus mucronatus L. Hubricht and J. G. Mackin, Amer. Midl. Nat. **23** (1): 201. 1940.
Bactrurus mucronatus L. Hubricht, Amer. Midl. Nat. **29** (3): 693. 1943.

Forbes's description and figures of this species, which he first discovered in a well at Normal, Ill., are very good, but I am here giving a figure of the anterior part of the animal and detailed figures of the gnathopods of the male. I am also figuring the mouth parts, which were not figured by Forbes.

The gnathopods of *B. mucronatus* have the palms slightly concave, and gnathopod 1 is

[1] Published by permission of the Acting Secretary of the Smithsonian Institution. Received October 31, 1944.

[2] HUBRICHT and MACKIN, Amer. Midl. Nat. **23** (1): 201, fig. 8. 1940.

shorter and appears to be somewhat stouter than 2. The mandibular spine-row contains 7 spines; second and third joints of mandibular palp subequal. Inner plate of first maxilla with 5 plumose setae; outer plate with 7 spine-teeth. Second maxilla with oblique row of plumose setae on inner plate. Inner plate of maxilliped is armed distally as follows: a sharp spine at the upper inner corner followed by a stout sharp spine-tooth, then a plumose or pectinate spine followed by a stout sharp spine-tooth and a curved spine; outer plate armed with 5 or 6 spine-teeth on inner margin.

The outer ramus of uropod 3 is rather

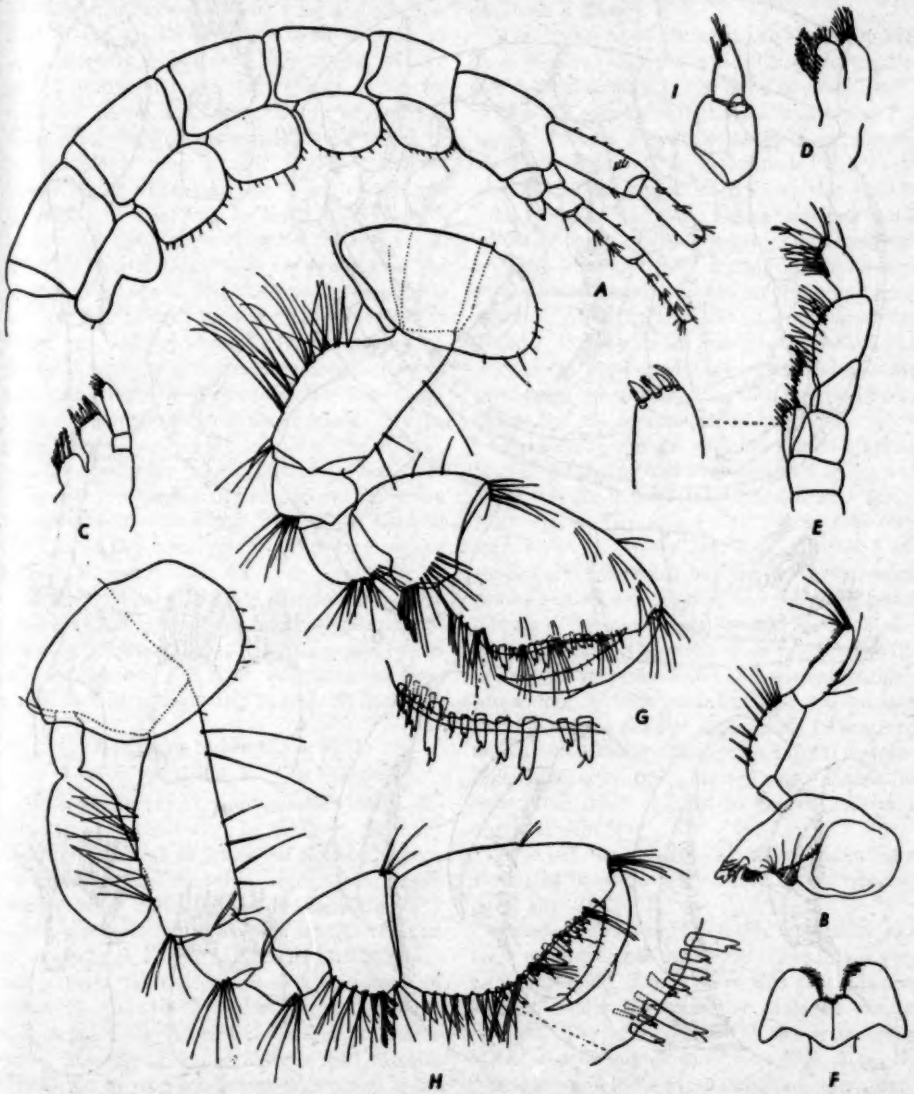


FIG. 1.—*Bactrurus mucronatus* (Forbes): Male: *A*, anterior half of animal; *B*, mandible; *C*, maxilla 1; *D*, maxilla 2; *E*, maxilliped; *F*, lower lip; *G*, gnathopod 1; *H*, gnathopod 2; *I*, uropod 3.

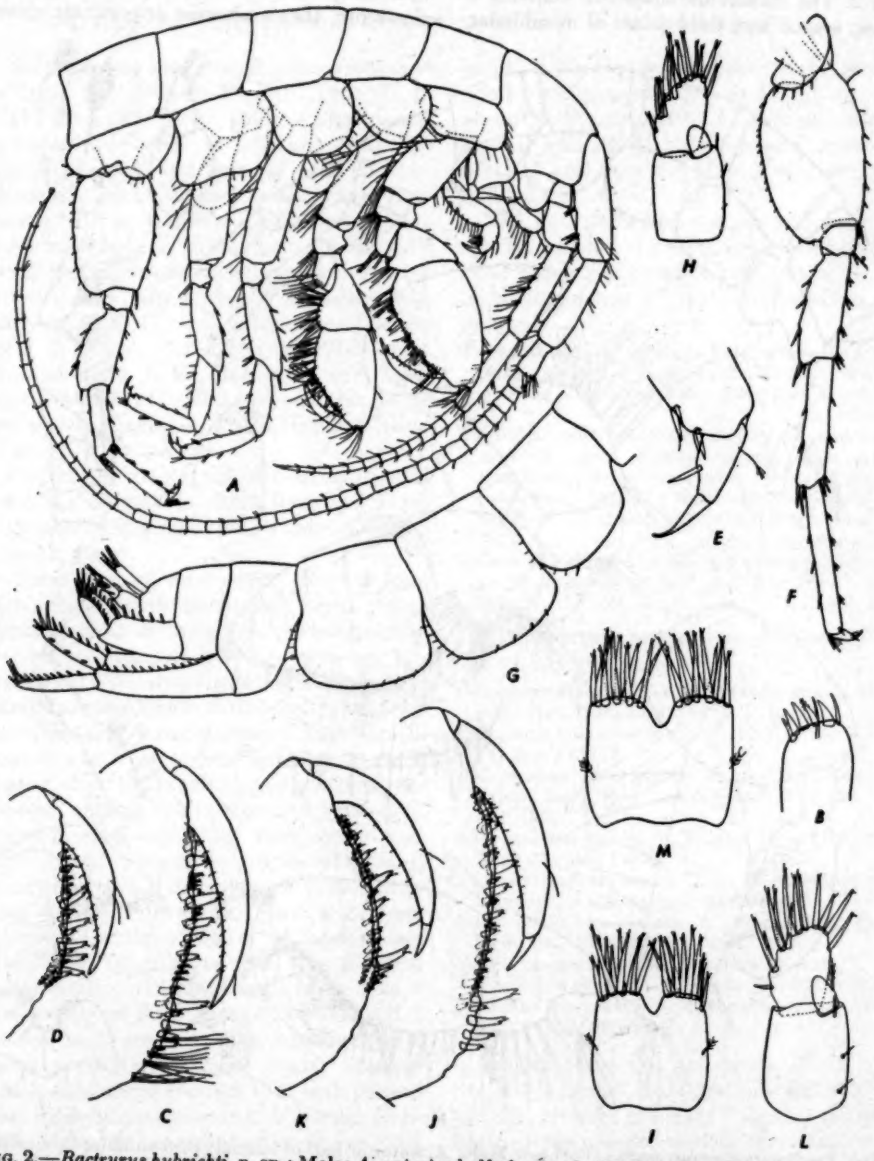


FIG. 2.—*Bactrurus hubrichti*, n. sp.: Male: *A*, anterior half of animal; *B*, apex of inner plate of maxilliped; *C*, *D*, palm of gnathopods 1 and 2; *E*, seventh joint of peraeopod 1; *F*, peraeopod 5; *G*, posterior half of animal; *H*, uropod 3; *I*, telson. Female; *J*, *K*, palms of gnathopods 1 and 2; *L*, uropod 3; *M*, telson.

slender, converges to the narrow truncate apex and is about as long as the peduncle; the inner ramus is very small and apparently unarmed. The telson of the male is very long and slender; that of the female is about twice as long as wide, slightly emarginate and armed distally with 2 groups of rather long spines. In the female the telson extends decidedly beyond the third uropods. Forbes says that the telson of the female is very similar to the telson of *Crangonyx gracilis*, but this is not correct, as the telson of *C. gracilis* in the female is somewhat wider than long and is cleft for about one-third its length. Coxal gills are present on the second gnathopods and the first 4 peraeopods but are not present on the fifth peraeopod in either sex. Lateral sternal gills are present on the sixth and seventh mesosome segments and may sometimes be present on the first metasome segment in either male or female. Forbes gives 9 to 10 mm as the length of the animal, but his specimens were apparently not fully grown, as some males in the national collection measure 16 mm from the front of the head to the end of the first uropods, and some of the females measure about 12 mm.

As no type has ever been designated for this species and as none of the original material appears to be extant, I am creating a neotype as follows: A male, U.S.N.M. 81546, taken from a well at Champaign, Ill., March 29, 1902.

Bactrurus hubrichti, n. sp.
Fig. 2

Male.—Antenna 1, peduncular joints decreasing consecutively in length; primary flagellum of about 40 joints, all of which except the first eight and the terminal joint bear small, slender sense clubs; accessory flagellum of 2 joints, the terminal joint very small. Antenna 2, fourth joint a little longer than fifth; flagellum shorter than peduncle and composed of about 13 joints. No sense organs present. Mouth parts very much like those of *B. mucronatus*. Maxilliped, inner plate armed distally as follows: at upper inner angle a sharp spine followed by two larger sharp spine-teeth, then a pectinate spine followed by another large sharp spine-tooth and a curved spine (Fig. 2, *B*); the outer plates in the male figured have 6 marginal spine-teeth on right plate and 5 on the left, but other males examined had as many as 7 teeth on a plate.

The first 5 coxal plates are as shown by Fig. 2, *A*. Gnathopod 1 perhaps a little shorter, but much stouter than 2. The palm of gnathopod 1 is slightly convex and that of gnathopod 2 is nearly straight. The armature of these palms is shown by Figs. 2, *C*, *D*. Peraeopods 1 and 2 subequal in length and alike in form; the seventh joint is strong and has a long sharp nail and a spine on inner margin. Peraeopods 3 to 5 increasing consecutively in length; the second joints bearing short spines on front and hind margins; seventh joints like those of peraeopod 1 and 2. Coxal gills are present on gnathopod 2 and all the peraeopods; lateral sternal gills are present on the sixth and seventh mesosome segments and the first metasome segment.

Metasome segments with lower hind margins broadly rounding and bearing short setae; and lower margin of segments 2 and 3 with a few short spines. Uropods 1 and 2 stout and very spinose, as shown by Fig. 2, *G*. Uropod 3 extends quite noticeably beyond the telson; outer ramus as long as peduncle and armed on outer margin with two groups of spines, each containing 3 spines, and a single spine proximally; inner ramus very small and without spines. Telson as long as wide; distal margin divided into two lobes by a shallow sinus, each lobe armed with about 10 long stout spines; lateral margins each with a central plumose seta. Length of male from front of head to end of uropod 1 about 21 mm.

Type.—A male, U.S.N.M. 80039, taken from a well at Topeka, Kans., by E. A. Popenoe, April 16, 1912.

Female.—The female closely resembles the male, the principal difference being in the second gnathopod. The palm of this gnathopod is convex, while that of the male is nearly straight. The arrangement of the spine-teeth of the gnathopods is shown by Figs. 2, *J*, *K*. The telson is a little wider than long, but otherwise like that of the male. Length of female from front of head to end of uropod 1 about 19 mm.

ICHTHYOLOGY.—Snyderichthys, *a new generic name for the leatherside chub of the Bonneville and Upper Snake drainages in Western United States.*[1]

ROBERT R. MILLER, U.S. National Museum. (Communicated by LEONARD P. SCHULTZ.)

During a preliminary survey of the species of cyprinid fishes currently referred to the genus *Gila*, I made a detailed study of the pharyngeal teeth and arches of the leatherside chub, *"Gila" copei*. This species has been classified in six different genera: *Squalius* Bonaparte, *Leuciscus* Walbaum, *Tigoma* Girard, *Cheonda* Girard, *Richardsonius* Girard, and *Gila* Baird and Girard,[2] but my work indicates that *copei* belongs to none of these. Therefore, I am erecting a new genus for its sole reception.

Snyderichthys, new genus

Genotype.—*Squalius copei* Jordan and Gilbert.[3]

Snyderichthys differs from the other *Gila*-like fishes of the West principally in having only four teeth in the main row of each pharyngeal bone, instead of five on the left side and four on the right. I have examined the pharyngeals of 34 specimens of *S. copei* as follows: 5 from Provo River, at Provo, Utah (U.S.N.M. 125138); 10 from the same place (U.S.N.M. 41632); 10 from Little Wood River at Shoshone, Idaho (U.S.N.M. 48041 and 48111); 2 of the 3 types of *Squalius aliciae*, a synonym of *Snyderichthys copei*, from Provo River near Utah Lake (U.S.N.M. 27412); 5 from the Beaver River at Beaver, Utah (U.S.N.M. 15795); and the 2 types of *Squalius copei* from Bear River, Evanston, Wyo. (U.S.N.M. 27409). Despite published tooth counts, these fish (with two exceptions noted below) have only four teeth in the main row of each side. The dental formula varies in these specimens from dominantly 2,4–4,2 in the Bonneville system to dominantly 1,4–4,1 in the specimens from Little Wood River. The pharyngeals of the two types of *Squalius aliciae*, which previously had been examined (presumably by Jouy), were 2,4–4,2 and 2,4–3,2, the third tooth of the right arch of the second pharyngeal appearing to be enlarged as if representing a fusion of two teeth. This abnormality was also noted in one specimen from Little Wood River, which had a formula of 1,4–3,1. In the two types of *S. copei*, the larger specimen has the right arch missing (teeth 1,4 on left arch, the single tooth represented by a strong alveolus), and the smaller one lacks the left arch (teeth 4,1 on right arch, one tooth of the main row represented by a prominent alveolus). No other specimens from Bear River are at hand. *Snyderichthys* differs further from the fishes currently placed in the genus *Gila* in having the gill membranes attached very close together rather than comparatively wide apart.

Of the other known genera of cyprinid fishes in the Bonneville and Columbia River drainages with biserial dentition, only three have four teeth in the main row on each side. These are *Rhinichthys* Agassiz (including the subgenus *Apocope* Cope), *Oregonichthys* Hubbs, and *Couesius* Jordan. *Snyderichthys* differs from each of these genera in lacking a barbel and differs further from *Rhinichthys* in the absence of basal radii on the scales. The monotypic genus *Oregonichthys*, with very large specialized scales, is obviously distinct, and *Couesius* (as represented by the type of *greeni*, U.S.N.M. 44454) is likewise not closely related to *Snyderichthys*. So far as known, the new genus is monotypic, and it is confined to the basin of Pleistocene Lake Bonneville in Utah, Wyoming, and Idaho, the Upper Snake River of Idaho and Wyoming, and the Wood River drainage of western Idaho.

It is a pleasure to name this distinctive fish in honor of the late John Otterbein Snyder, in recognition of his pioneering work on western fishes. *Snyderichthys* takes its place among the peculiar cyprinid genera *Ictichthys* Jordan and Evermann, *Mylocheilus* Agassiz, *Acrocheilus* Agassiz, and *Oregonichthys*, which are confined to the Bonneville and Columbia River drainage basins.

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[2] See JORDAN and EVERMANN, U. S. Nat. Mus. Bull. 47, pt. 1: 236. 1896; JORDAN, EVERMANN, and CLARK, Rep. U. S. Comm. Fish., pt. 2: 119. 1928 (1930); SIMON, Wyoming Wild Life 7 (4): 7, 1 fig. 1942; SIMON and SIMON, Univ. Wyoming Publ. 6 (4): 51, 61. 1942; TANNER, Utah Acad. Sci., Arts and Letters 13: 160, 169. 1936.

[3] Proc. U. S. Nat. Mus. 3: 461. 1880 (1881).

ICHTHYOLOGY.—Pygidium mondolfi, *a new catfish from Venezuela.*[1]

LEONARD P. SCHULTZ, U. S. National Museum.

Recently, three specimens of a South American catfish, collected near Caracas, Venezuela, by Sr. Egardo Mondolfi and Sr. Vivas, were turned over to me for study. After careful comparisons were made with related species in the collections of the United States National Museum, it was concluded that these fishes represent a distinct species, and this is described below and named in honor of Sr. Mondolfi, through whose efforts the specimens were collected and forwarded to me. It is regretted that they were received too late to be included in my recent paper on *The catfishes of Venezuela* (Proc. U. S. Nat. Mus. 94: 173–338, figs. 1–5, pls. 1–14. 1944).

Genus **Pygidium** Meyen
Pygidium mondolfi, n. sp.

Holotype.—U.S.N.M. 120377, a sexually mature male, 60.5 mm in standard length, collected by Sr. Egardo Mondolfi and Sr. Vivas, July 16, 1939, from Quebrado Chacaito near Caracas but in Estado de Miranda, Río Tuy system, Venezuela.

Paratypes.—U.S.N.M. 120378, 2 specimens, 45.5 and 33 mm in standard length, collected along with the holotype and bearing the same data.

Description.—Based on the holotype and two paratypes. Measurements, expressed in hundredths of the standard length, are recorded for the holotype then paratypes in parentheses, respectively. Standard lengths in mm. 60.5 (45.5; 33). The two longest specimens are sexually mature males.

Length of head 19.3 (19.8; 20.0); width across body at pectoral insertions 14.4 (15.4; 17.3), greatest depth of body 17.2 (18.5; 15.2); length of snout 7.28 (8.78; 7.88); diameter of eye 1.98 (2.20; 2.73); least width of fleshy interorbital 5.12 (4.62; 5.76); postorbital length of head 9.58 (10.5; 10.3); length of longest ray (first branched) of anal fin 10.4 (11.2; 10.0); longest dorsal ray 10.1 (11.2; 10.6); longest pelvic ray 6.62 (7.90; 8.18); longest (first) pectoral ray 10.6 (14.3; 13.9); longest caudal ray 12.2 (14.3; 14.8); least depth of caudal peduncle 10.6 (11.0; 11.2); length of caudal peduncle from base of last anal ray to midcaudal fin base 18.8 (20.4; 20.0); distance from tip of snout to origin of dorsal fin 65.3 (66.8; 66.7); snout to anal origin 75.3 (72.5; 74.2); snout to pelvic insertion 63.2 (58.6; 62.1); snout to anus 72.7 (68.6; 70.3); pelvic insertion to anal origin 13.4 (13.4; 11.5); length of upper maxillary barbel 8.27 (13.4; 13.0); length of lower maxillary barbel 6.62 (9.67; 9.09); length of nasal barbel 6.94 (10.8; 12.1); distance from edge of eye to margin of posterior nasal opening 1.98 (2.42; 2.42); distance from tip of first pectoral ray to pelvic insertion 37.2 (30.2; 30.3); distance that first pectoral fin ray projects beyond other pectoral rays 1.65 (2.20; 1.51); distance from dorsal origin to midcaudal fin base 32.7 (31.9; 30.6); anal origin to midcaudal fin base 26.4 (27.0; 26.4); pelvic insertion to midcaudal fin base 38.8 (40.1; 39.4).

The following counts were made, respectively: Dorsal rays, v, 5 (iv, 6; iv, 6); anal iv, 4 (iv, 4; iv, 4); pectoral i, 7-i, 7 (i, 7-i, 7; i, 7-i, 7); pelvic i, 4–i, 4 (i, 4–i, 4; i, 4–i, 4); branched rays of caudal fin 10 (11; 10).

Teeth all conical; anal origin under a vertical line through fourth branched dorsal fin ray; dorsal origin in front of a vertical line through front of anus; depressed dorsal fin reaches to opposite middle of depressed anal fin; pelvic fins not quite reaching to anus; pectorals much shorter than the head, the first ray little prolonged; nasal barbel reaches a little past the eye; upper maxillary barbel reaching about two-thirds the way to rear of opercle, and lower maxillary barbel a little shorter. The eye is in the anterior half of the head, the rear of orbit about equidistant between tip of snout and rear of head; the caudal fin is rounded or what may be considered as truncate-rounded, at least the middle rays are longest; dorsal and anal rounded; the pectoral fins are short and the first pectoral fin ray is barely prolonged; the dorsal origin is about equidistant between tip of caudal fin and base of pectorals; distance from midcaudal fin base to dorsal origin about 1.9 times in distance from tip of snout to dorsal origin; pelvic insertions about equidistant from midcaudal fin base and middle of length

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of pectoral fisn; distance between pelvic insertions and anal origin is contained from 2⅓ to 2⅔ times in distance from tips of pectoral rays to pelvic insertion.

Coloration.—A distinct interrupted dark brownish lengthwise streak, a trifle above the midaxis of body, formed of irregular-shaped dark brown blotches more or less elongate, these blotches with extensions of the pigment dorsally, sometimes reaching nearly to the back, but ventrally this streak of elongate blotches ends abruptly; below dark streak on the largest two specimens are minute brown specks, but lacking in the smaller specimen; above the dark lateral streak are numerous irregularly shaped brown blotches, less distinct and smaller than any forming the lateral stripe; area around nasal openings darkish; peritoneum white ventrally, dusky dorsally and laterally.

Remarks.—This new species belongs among those species of *Pygidium* with these characteristics: Conical teeth; a rounded or truncate-rounded caudal fin; the dorsal origin a little closer to midcaudal fin base than tips of pectoral rays; pelvic insertions a trifle closer to tips of pectoral fin rays than midcaudal fin base; with the eyes located just in front of middle of head length and the sides with a lateral streak of dark blotches. In this group *P. mondolfi* is related to the following:

In *P. dorsostriatum* Eigenmann, *P. lotistriatum* Eigenmann, and *P. venulosum* Steindachner, the dorsal origin is farther forward so that it is equidistant between tip of caudal fin and some point on the head instead of near tips of pectoral rays as in the new species.

In *P. regani* Eigenmann the maxillary barbel reaches beyond the head, but in *P. mondolfi* it does not reach to rear of head.

In *P. striatum* Meek and Hildebrand, the pelvic insertion is equidistant between midcaudal fin base and rear of head instead of tips of pectoral rays as in *mondolfi*, and in the latter the barbels are much shorter, not reaching rear of head.

Pygidium mondolfi may be distinguished from other species of *Pygidium* reported from Venezuela by the following key:

1*a*. Caudal fin rounded or truncate-rounded, middle rays longest.
  2*a*. Maxillary barbels slender, reaching to middle of pectoral rays; nasal barbel short, reaching a little past eye, or about halfway to end of operculum; origin of dorsal a trifle closer to base of midcaudal fin rays than to tips of branched rays of pectoral; insertion of pelvics equidistant between base of midcaudal fin rays and end of operculum; length of upper prolonged pectoral ray 1½ times in distance from its tip to insertion of pelvics; a vertical line through origin of dorsal passes a little closer to insertion of pelvics than to anus; dark diffuse spots or blotches, no lateral band. . *Pygidium meridae* (Regan)
  2*b*. Both maxillary as well as nasal barbels not reaching beyond three-fourths way to rear of opercle; origin of dorsal much closer to midcaudal fin base than tips of pectoral rays; insertion of pelvics an equal distance between base of midcaudal fin rays and rear of pectoral fin; length of upper or first pectoral fin ray 2½ to 3 times in distance from its tip to pelvic insertions; a vertical line through dorsal origin passes about an equal distance between pelvic insertions and middle of anus; a dark lateral streak composed of dark brown blotches, with other smaller dark blotches dorsally. *Pgidium mondolfi*, n. sp.
1*b*. Caudal fin emarginate or a little concave.
  3*a*. Color plain or sides with one or more continuous dark lengthwise bands, but no dark spots on back or sides.

FIG. 1.—*Pygidium mondolfi*, n. sp.: Holotype, U.S.N.M. 120377, from Quebrado Chacaito near Caracas, Venezuela. Ca. ×2. Drawn by Mrs. Aime M. Awl.

4*a*. Three dark bands, two on sides, one along middorsal line anteriorly; a wide diffuse blackish band along lateral line with wide pale streaks above and below; a second wide blackish band above upper pale band beginning at base of nasal barbel and passes through eye, thence along upper sides close to base of dorsal fin, thence fading posteriorly on upper sides of caudal peduncle; a third blackish streak separated from second black band by a pale streak runs along middorsal line of head and back, fading in front of dorsal fin; nasal barbel long, reaching past end of operculum; origin of dorsal equidistant between base of midcaudal fin rays and posterior one-fourth of length of branched pectoral rays; insertion of pelvics equidistant from base of midcaudal fin rays and middle of postorbital length of head or eye in young; length of prolonged upper ray of pectoral fin about equal to distance from its tip to insertion of pelvics; usually a more or less evident dark streak across outer two thirds of length of caudal fin.

Pygidium emanueli emanueli Schultz

4*b*. Three dark bands on sides, none along middorsal line of back anteriorly; a blackish band on midsides along lateral line, above and below which is a pale band or streak; below lower pale streak another band, more or less a series of diffuse blotches running together, beginning in axil of pectoral and continuing above pelvic base and fading posteriorly; a third intense dark band above upper pale streak, beginning at base of nasal barbel, passing through eye, thence a little distance away from base of dorsal, fading posteriorly; origin of dorsal fin equidistant from base of midcaudal fin rays and middle of length of branched rays of pelvics; insertion of pelvics equidistant from base of midcaudal fin rays and about middle of postorbital length of head; nasal barbel reaching past end of operculum; length of upper prolonged pectoral ray contained 1 to 1-1/7 times in distance from its tip to insertion of pelvics.

Pygidium emanueli motatanensis Schultz

4*c*. Color plain in adults, but in young about 30 to 40 mm or shorter a single black streak occurring along midsides, but at 70 mm streak barely discernible; origin of dorsal equidistant from base of midcaudal fin rays and tips of branched rays of pectoral; insertion of pelvics equal distance from base of midcaudal fin rays and middle of postorbital length of head; length of first (prolonged) ray of pectoral contained 1¼ to 1⅓ in distance from its tip to insertion of pelvics; nasal barbel reaching a little past end of operculum; pelvics not reaching past anus.

Pygidium knerii Steindachner

3*b*. Back or sides or both with numerous blackish or brownish spots, these small or of moderate size; caudal fin a little concave; belly plain; sometimes spots along midsides more or less fusing into a dark, narrow streak; origin of dorsal a little closer to tips of branched rays of pectoral fin than to midbase of caudal fin; insertion of pelvics equidistant from midcaudal fin base and second third of postorbital length of head; length of upper prolonged ray of pectoral 0.9 to 1.2 times in distance between its tip and pelvic insertion; nasal barbel extends considerably past end of operculum.

Pygidium banneaui maracaiboensis Schultz

Obituaries

HARRY FIELDING REID, emeritus professor of dynamical geology and geography at the Johns Hopkins University, died on Sunday, June 18, 1944, just one month after his 85th birthday. Born in Baltimore, he took his A.B. and Ph.D. degrees at Johns Hopkins. After graduation he served successively as professor of mathematics and then of physics at Case School, returning to his alma mater in 1894 as lecturer, then as professor of geological physics, retiring in 1929. He is survived by his wife, Edyth Gittings, a son, and a daughter.

His was a long and distinguished career as a scientist as evinced by his early election to the National Academy of Sciences. He was devoted to the precise thinking and rigid demands of proof which doubtless grew out of his mathematical training and exercised a very salutary influence by both example and precept in the field of geology which is, to such a large degree, an eclectic science. Trips to Switzerland and Alaska to investigate glaciers and an absorbing interest led to his presidency of the Seismological Society of America and presidency of the Geophysical Union as well as to his appointment to the California Earthquake Commission and to that which made a study of the Panama Canal slides. Along with the late Joseph S.

Ames, he was sent to Europe during the early part of World War I to report on the contributions of British science to the war effort.

Dr. Reid was a member of the American Philosophical Society, the International Geodetic and Geophysical Union, Geological Society of America, Seismological Society, Société Hélvetique des Sciences Naturelle, International Seismological Association, Washington Academy of Sciences, Philadelphia Academy of Sciences, and others. He was Hitchcock lecturer in 1911.

He served his state as director of the Highway Division of the Survey for several years. He will be widely missed in all quarters where clear and precise thinking is practiced. It seems to me that the highest tribute that can be paid his memory is that all his life he was a high-minded gentleman and scholar.

EDWARD W. BERRY.

On June 3, 1944, "finis" was written to the many-sided crowded career of WILLIAM MALCOLM CORSE, a member of the Academy since 1923 and, at the time of his death, vice president representing the Society of Military Engineers. Brimming over with vitality, energy, and enthusiasm, Mr. Corse was an outstanding figure in American metallurgical circles for many years. He was born at Malden, Mass., in 1878, of New England parentage dating back to early colonial days. Twenty-one years later he was graduated from Massachusetts Institute of Technology. He soon turned from chemistry, his first interest, to metallurgy as a life career and during a period of 20 years (1902–1922) had a wide and varied experience. He held a number of metallurgical industrial positions of constantly increasing importance. Brass was seemingly his favorite, although nickel and bearing metals were close seconds. During World War I, on a special Navy civilian assignment, he spent much time at the Portsmouth, N. H., Navy Yard on brass foundry problems. His Washington career began in 1922 with the National Research Council and his special assignment of administrative work in connection with the International Critical Tables project. After 1925 he conducted a metallurgical consulting service in Washington in the course of which his ability to make and hold friends was strikingly demonstrated. He became well known in Army, Navy, and other Washington circles.

Mr. Corse's outstanding ability as a leader and organizer is well illustrated by the leading part he played in 1912 in the organization of the American Institute of Metals, now the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers. For 20 years he served either as the secretary-treasurer or secretary of this unit. He also served as the American corresponding secretary of the British Institute of Metals for many years up to the time of his death. For over 21 years he was a member of the metallurgical advisory committee of the National Bureau of Standards, where he will long be affectionately remembered. He played an important part in the organization of this committee by his close friend Dr. George Kimball Burgess, then chief of the Division of Metallurgy.

He was the author of the book *Bearing Metals and Bearings*, a pioneer in the field published as one of the technologic series of the American Chemical Society, as well as many technical papers dealing with metallurgical subjects. His many nonmetallurgical interests are illustrated by his membership in the Society of Colonial Wars, Sons of American Revolution, Arts Club of Washington, Cosmos Club, Rotary Club (Keene, N. H.), Society of American Military Engineers, and Army Ordnance Association.

Mr. Corse was married twice, and through the son of the daughter of his first wife his name is carried on. He is survived by his wife at the home, "Windy Hill," Westmoreland, N. H., to which he retired a few years ago when his health first became impaired. As a man who always rang true as the metal with which he worked and as a sympathetic friend with an earnest disposition to make others happy, he will long be remembered by his many associates in the metallurgical profession.

H. S. RAWDON.